A Cotton Fabrics Glossary

CONTAINING INSTRUCTIONS FOR THE MANUFACTURE OF EVERY KNOWN GRADE AND VARIETY OF COTTON FABRICS.

COTTON VOILES

Until within the past few years, voile fabrics were made and sold in quite large quantities, considering the material from which they were made, but inasmuch as they were composed of worsted yarn, they were high in price and not especially desirable to the large majority of consumers. Possibly four or five years ago, voiles began to be made of cotton yarn, and while they are not so desirable in some ways as fabrics composed of worsted yarn, nevertheless they are very attractive, and for ordinary users show a much larger value than when made from worsted.

Gradually the style for such fabrics developed and for the past two years there has been possibly a greater sale for them than there has been for any other material manufactured in fancy cotton mills or for cotton fabrics which come under a fancy classification. The smoothness of the cotton yarns adds a great deal to the general cloth effect and has without doubt created a field which will show a greater or less demand continually.

It is not likely that the sale will be as large as it is now or has been recently, but these fabrics show such a large amount of desirability that they cannot be dropped from the ordinary range of fancy fabrics to as great a degree as some others have been in the past. Naturally, the variety of fabrics produced from cotton yarns shows a much

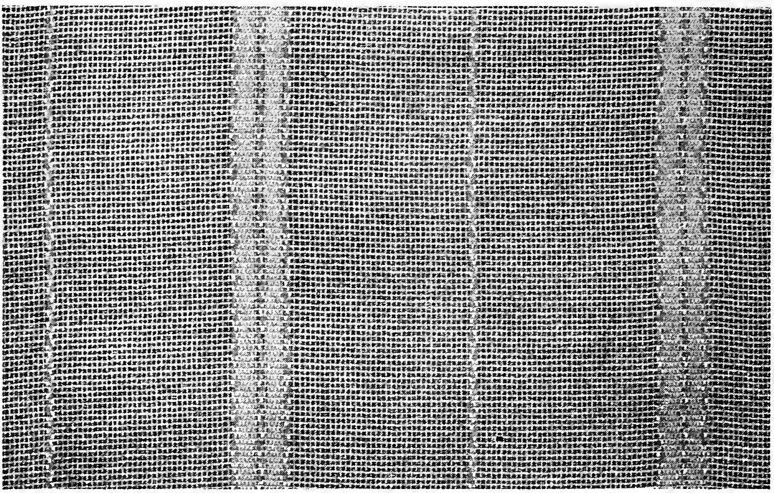
WIDER RANGE OF STYLE

and construction than they did from worsted, because cotton mills are better equipped to make a variety of combinations in yarn sizes, and also through the addition of other materials, such as silk, artificial silk and other fibres, to give certain effects.

When voile fabrics were first made in cotton, the large majority of them were produced from two-ply yarn, and, naturally, much of this yarn was made from combed stock, because one of the main features of the fabric is to have as clear an effect as possible, or one in which there are as few fibres projecting from the yarn as possible. The twisting operation aids perceptibly in making yarn smooth, and for this reason it is used extensively. To give crispness and also to aid in making the yarn round, it is given a much greater amount of twist than ordinary two-ply yarn, and regarding this situation, we will give a more extensive description later. There are also a good many voile fabrics which have been produced from single yarns, but, of course, they are not as serviceable nor as desirable as the two-ply fabric, although they do offer opportunities in purchasing at a reduction in price

As a general statement, it can be said that voile fabrics have a very low count in comparison with most other fabrics. This is done in order that it may aid in giving the open effect which is so desirable in the fabric, for it must be remembered that when a voile fabric is used for a dress or for most other uses, it is necessary to wear underneath an other dress or fabric to make the garment opaque and aid in creating a desirable effect, for combinations in colors between over-dress and under-dress are often used.

One of the great problems in the making of any voile cloth is to have the construction of the cloth just right, that is, so that the threads will not slip badly and still not be so close as to detract especially from the open-work effect. Voiles have often been sold in which the construction was too high, and which might have been lowered with a distinct saving in cost and a resulting better effect, and it is also true that voiles have been sold in which the construction was too low, for the threads slip badly and often create a wavy appearance. It is probable that the low constructions are much more frequent than the high constructions, because buyers are likely to cut the costs everywhere possible whenever an opportunity is presented. Because there has been a low count used in these cloths, in the large majority of instances, the body of the fabric at least is composed of plain weave. Unless this is done a higher count is necessary for any size of yarn, and when the cloth count is increased the voile effect is lost.



A Coarse Blue Voile of 45-1 Yarn.

Some variation in count will be noted through the use of different staple lengths of cotton; that is, when a long cotton is used a smooth yarn is likely to be produced and the smoother a yarn is, the more it is likely to slip when woven. It is also true that it is not necessary to use as much twist when a long cotton is used as when a short one is being spun. Through the low construction, or small number of picks per inch, the production in yards on voile fabrics is much greater than it has been on the majority of fabrics which fancy mills are accustomed to produce, even

though the percentage of production has not been as high as it has been on other fabrics.

Each mill is likely to use a somewhat different amount of twist in its yarns, due to somewhat different manufacturing conditions under which each operates, but as a general thing, it can be said that the cotton which is used in any kind of voile yarn is that which is ordinarily used in the yarn of the same size which would be used in a fancy fabric. In combed yarn fabrics, it is seldom that cotton shorter than this, 1⅛ inches, is used, because cotton shorter than this is seldom combed. It is a general mill policy to use just as short staple for any size of yarn as can be handled successfully, and it is not a good policy to use cotton which costs an extra cent or two when the advantage gained only amounts to a small portion of a cent.

Inasmuch as the making of voile fabrics depends so much on the yarns used, it may be well to give some information regarding their construction and making. These ply yarns are both made from grey single yarns and also from dyed and bleached single yarns, but by far the largest majority are made in the grey state. Inasmuch as they are two-ply or more than two-ply, it is readily recognized that a twisting operation is necessary before they are completed. Of course, when the yarns are made in the dyed or bleached state before weaving, it makes little difference regarding the cost, because practically the same number of processes have to be used, no matter what method is pursued, but this is not true when grey yarns are being considered.

In the first place, in making grey ply yarns, if they be taken and placed on the twister and twisted, they must also be handled by other succeeding processes, that is, the warp be spooled, warped and slashed just the same as any other warp yarn. The slashing operation

SETS THE TWIST

on the warp, so that it does not curl up and create any great trouble, but the filling cannot be quilled after twisting, but must be made up into a long chain warp and then sized and quilled before it can be woven. Unless this is done, the hard twist in the yarn is likely to make loops which appear in the cloth and make seconds. It has been found that so far as twisting the filling is concerned, it is much better to twist the two-ply on a spinning frame. This can be done by using filling bobbins which have been enamelled so as to stand a steaming process. When the filling yarn has been twisted or spun onto these bobbins, it can be taken directly from the spinning frame to a steaming chest, which sets the twist and makes the yarn in a condition ready for weaving.

As will be readily seen, this method of making hard twist two-ply grey filling yarn is more desirable than when twisted on a twisting frame, because it eliminates a number of processes and results in a cheaper yarn cost. This operation cannot always be accomplished on a spinning frame, because they are sometimes not available, but it is a distinct advantage when it can be accomplished. When single yarns are being used in making a voile cloth, it is customary to use in some cases an ordinary warp yarn and in others a warp yarn in which there is only a slight excess of twist, while the filling yarn contains the extra hard twist. In making single yarn voiles it is necessary to use

ENAMELLED BOBBINS

for the filling, so that it can be steamed as above described on the two-ply yarn. For ordinary warp yarn the standard of twist is from 4¼ to 4¾ times the square root of the yarn size, whereas in hard twist yarn, such as is used in voiles, the standard of twist is likely to be from 7 to 8½ times the square root of the yarn size. This holds true for both warp and filling and for both single and two-ply yarn, with the single exception of warp yarn used in single yarn voiles. In making the single yarn, which is used

before twisting, the standards of twist are almost always exactly the same as if ordinary warp yarn were being produced; that is, ordinary warp yarn can be taken and hard twisted, and then it is suitable for use in voiles.

Thus it will be seen that the production of a voile yarn is likely to be only about half that noted on an ordinary yarn, and for this reason the cost of production is likely to be about twice as much as it is on an ordinary single or two-ply yarn of the same size. The twist in the two-ply yarn voiles for both warp and filling is practically always identical if the same size of yarn be used for warp and filling.

ANALYSIS NO. 1.

Width of the warp in reed......28¾ inches
Width of the fabric grey........27 inches
Width of the fabric finished.....26 inches
Ends per inch in the reed.......34
Ends per inch finished...........38
Reed (1 end per dent)...........34
Ends in the warp $\frac{2}{12}$ 966 $\frac{2}{12}$ = 1,014 total ends.
Warp yarn size 45/2.
Warp take-up 6%.
Warp weight .0583.
Filling size 45/2.
Picks per inch 34.
Filling weight .0528.
Total weight per yard .1111.
Yards per pound (grey) 9.

The above fabric is the one ordinarily known as 38x34, and has been sold in quite large quantities not only in the plain material but also in various dobby and striped patterns. The ply yarn in this fabric is made of 45-1 single yarn, and in the twisting operation there is a certain amount of contraction, and instead of this yarn containing 18,900 yards per pound, we have used as a basis 18,500 yards, a figure which allows for shrinkage in possibly an average number of instances. With a very high standard of twist, the yarn will shrink more, while if the standard is lower there will be less contraction. Two-ply hard twisted yarns are usually made from single yarns of a certain size, and the two-ply result is likely to be coarser in size than the single yarns used would indicate. When single hard twisted yarns are being made, it is customary to change the gears so that the yarn spun is a certain size.

ANALYSIS NO. 2.

Width of the warp in the reed.....29 inches
Width of the fabric in the grey....27 inches
Width of the fabric finished.......26 inches
Ends per inch in the reed.........46
Ends per inch finished............49
Reed (1 end per dent).............46
Ends in the warp 24 1,310 24 = 1,358 total ends.
Warp yarn size 60/2.
Warp take-up 7%.
Warp weight .0628.
Filling size 60/2.
Picks per inch 46.
Filling weight .0574
Total weight per yard .1202.
Yards per pound (grey) 8.32.

This above cloth is another one which is manufactured extensively, and is known as 49x46 with 60-2 hard twist warp and filling. The twisted yarn is made from 60-1 warp yarn and due to contraction in twist, it contains only 23,250 yards per pound, instead of 25,200. There is also a single yarn voile, which is made from carded and also from combed yarn with counts about 50x48, and contains yarns in the vicinity of 30-1, the cloth being somewhat similar in weight to the one given in analysis No. 2, except that there is a difference in appearance and cost which would be noted between a single and two-ply fabric. Then there are many fabrics made of fine two-ply yarns, and a large portion of the imported voiles are made from yarns up to and even higher than 120-2.

The count on such fabrics is seldom higher than 64x64, that is, unless the yarn is of extremely fine size. In order to increase the smoothness of the ply yarn it is often customary to use a gassing process after the yarn is twisted, which burns off the fibres of cotton projecting and which, although adding to the expense of production, is sometimes the means of returning a higher profit to the manufacturer because of added attractiveness.

WEAVING.

Practically all of the voile fabrics which have been sold have been woven on ordinary or fancy looms, even though some of them have been en-

tirely of plain weave. This has been because mispicks and breakages cause seconds to be made much quicker than would be noted on a cheaper class of fabrics and also because the fancy mills which are able to produce the right kind of yarns have not had automatic looms to use even had they so desired. Without doubt, the use of stripes made in various methods out of cotton or silk has added much to the attractiveness of voile fabrics and has been responsible for a portion of the large sale.

When silk stripes have been used, fancy weaves have been employed on the stripes in many instances, and this is very desirable. The addition of a comparatively small amount of silk yarn is usually warranted through the higher selling price obtained and the higher rate of profit which a mill can obtain through this method of manufacturing. Generally, the weaving process causes very little difficulty, for the yarns are strong, even though they are hard twisted, and, due to the low cloth count, there are only a comparatively few warp threads to be looked after by a weaver, that is, unless there are crowded silk or cotton stripes.

Probably, the large use of voiles has been the means of introducing to consumers in a large way the use of artificial silk. On fine fabrics, which are woven with a fine reed, there is a good deal of friction, which causes artificial silk warp threads to rub and fray out and be rather unsatisfactory in weaving, which fact has curtailed their use to a certain extent in the past, but the coarse count of voile fabrics and the comparatively small amount of rubbing in weaving has made the use of this silk entirely satisfactory and much more of it is being noted, especially in the imported lines. Consumers have found that the use of this silk is not undesirable, and that there has been a change of sentiment, as shown by the fact that retailers to-day designate that such material has been used in making the cloth when they are showing the goods, while even one year ago it was very hard to find a case where such use was brought to a consumer's attention, although the material was used quite extensively at that time.

FINISHING.

For the fabric which is woven from dyed and bleached yarns there is no great necessity for any extra finishing processes after the cloth comes from the loom, and when it has been examined, washed, ironed and folded, it is ready for sale; in other words, the treatment of such cloth is very similar to other dyed yarn fabrics. The cloth which is woven from grey yarn is treated in an entirely different manner, and the results obtained may be of widely different character, even though the same grey cloth is used as a basis.

In the first place, the grey fabric is bleached, and this process is likely to vary, depending upon the materials which have been used in the cloth. For an ordinary all cotton voile, the ordinary bleaching process may be used, but when silk is used in combination for stripes or checks, it must be bleached by a method which will not harm either material, and possibly sodium peroxide is more extensively used than any other material for bleaching such combination fabrics. After the voile fabric is bleached, it may be dyed a solid color or left white if the cloth is plain weave, or it may be printed in allover patterns or with various styles of borders, such as are being used and which have been popular since voiles have been selling well.

Then it is also true that many of the finer and more expensive fabrics are treated to a mercerization process, as this seems to make the threads rounder and the voile effect better. The process acts, so far as results are concerned, much the same as if the ply yarn composing the fabrics had been treated to a gassing operation before being woven. Such a process is even being applied to many of the ordinary voiles, especially since the

large use of mercerization has made the cost of doing it much less, and which does not make the fabric prohibitive in price. On fancy fabrics which contain silk there are other results besides the foregoing possible, for, besides being mercerized and sold in the white state or dyed solid colors or printed, the cloths can be dyed with certain colors, which is called cross dyeing, so that the silk yarn appears as one color, while the cotton is another, and it is also noted that many of the fabrics have the silk yarn with the cotton yarn in the color desired.

On the cheap voiles which are only printed, the cost of finishing may be as low as 1¼ cents a yard, or if sold in the white state even less than this amount, while on the high-priced fabrics the cost may be much higher, and it is probable that most of the better fabrics being offered by the retailers cost from 3 cents to 3½ cents to finish, that is, it costs the converter who handles the goods this amount to have it done.

CARDING AND SPINNING.

The yarns which are used in the making of voiles are varied, but in general the foundation yarns are much the same as those which would be used for the same kinds of cloth in a fancy cotton mill. For fine yarn longer cotton is used than for coarse yarn, but for the 45-2 yarn in the fabric, for which an analysis is given, the cotton staple length would be about 1 3-16 inches, while for the 60-2 fabric the cotton length would be about 1¼ inches, and if 100-2 were to be used, the cotton length would be about 1½ inches.

In combing cotton for medium or coarse yarn sizes, the percentage of waste removed is less than when fine yarns are to be made, the amount of waste removed depending upon circumstances. There should be a good mixing of cotton before it is run through the pickers, as this is one of the features which results in even yarn which is so necessary in the production of voiles, while the weights of sliver will depend a good deal on the mill organization and also on the kind and size of comber being employed. The spacing of the rolls on the various machines should be wide enough, so that in no case will the cotton fibres be broken, and the amount will vary on the different machines from one-eighth inch to one-quarter inch more than the cotton staple length. Assuming that a finished drawing sliver is being produced of a weight of 40 grains and that three processes of fly frames are to be used, a lay-out for one yard of 45-1 yarn would be about as follows:

.1852 grain.
.98 2% contraction in spinning.

.1815
10.58 spinning draft.

1.92 ÷ 2 ends = 96 = 8.67 hank roving.
6.4 fine frame draft.

6.16 ÷ 2 ends = 3.08 = 2.70 hank roving.
5.65 intermediate frame draft.

17.4 ÷ 2 ends = 8.70 = .96 hank roving.
4.6 slubber frame draft.

40.00 grains finisher drawing weight.

If four processes of fly frames are to be used in producing 45-1 yarn, it probably would be better to use a heavier finished drawing sliver, and through the greater opportunity for drawing, due to the extra process, the right size of yarn can be obtained. It is a very good policy not to have the spinning draft much over 10½, although there are mills where this is exceeded somewhat. Conservative drafts and speeds will usually be of ultimate advantage in manufacture, for it not only is likely to result in a greater yarn production, but it is likely to make fewer seconds in the cloth room, a higher percentage of production on the loom, with a corresponding lower cost, and also a better fabric, which will command a higher price because of the better yarn composing it. What would be a good layout for one mill would not be so good for another, but this statement does not mean that there are mills which could not improve their yarn layout, either by changing the drafts or changing the speeds or even adding a few machines so as to

give a greater amount of flexibility to the organization. There is such a wide range of up-to-dateness in the machinery in the various mills that one mill can operate to advantage with cotton of 1⅛ inches in length, while another for the same size of yarn may have to use 1¼-inch stock. The problem is an individual one, which cannot be decided quickly, and to give a layout which would be entirely suitable or even desirable for general mills conditions is not an especially good policy.

DYEING INSTRUCTIONS.

The following dyeing instructions may be used for the dyeing of this kind of material. In a general way, the goods will be worked in the dye liquor for approximately three-quarters of an hour at the boiling point. The amounts of color are based on the supposition that 100 pounds of material is to be dyed, and for this amount of material, there will be required somewhere in the vicinity of 180 gallons of liquor. The amounts of dyestuffs and other materials are those necessary for the first batch of material:

BLUE.

¾% Oxamine Blue, 3 B. N.
10-20% Glauber's salt crystals.

PINK.

1-25% Cotton Red 4 B. X.
10-20% Glauber's salt crystals.

RED.

2½% Thiazine Red R.
10-20% Glauber's salt crystals.

BROWN.

2½% Cotton Brown G.
10-20% Glauber's salt crystals.

ORANGE.

2½% Pyramine Orange R. R.
10-20% Glauber's salt crystals.

SLATE.

1-10 of 1% Oxamine Black, R. N.
10-20% Glauber's salt crystals.

YELLOW.

1% Stilbene Yellow, 2 G. P. extra Conc.
10-20% Glauber's salt crystals.

MERCERIZED WAISTINGS

There has developed during comparatively recent years, or since the mercerization process has been permitted to be used, a class of fabrics of wide variety, but which have quite a number of prominent features in common. This class of fabrics contains those which are mercerized in the piece in the filling direction, and these materials are used extensively for women's waistings and dresses, for men's shirtings and for various other purposes which creates for them a large field for sale. These cloths are produced in plain weave and also with dobby and jacquard figures, and the results obtained appear to many consumers to be comparable to some silk fabrics, in fact they are quite often sold as such, for the lustre obtained through such methods is permanent.

Since the introduction of fast colors which are able to stand the bleaching process there has been a greater opportunity for variety than there was earlier, and it is probable that the sale of such fabrics has hurt the sale of the older style madras shirtings to quite an appreciable extent, for shirt makers can thus purchase their cloth and convert it themselves, thereby saving quite large amounts on certain lines. There has been some criticism regarding the wear of many of these new fabrics, it being claimed that they do not wear as well as the older lines and that mercerization hurts the cloth quality, but this

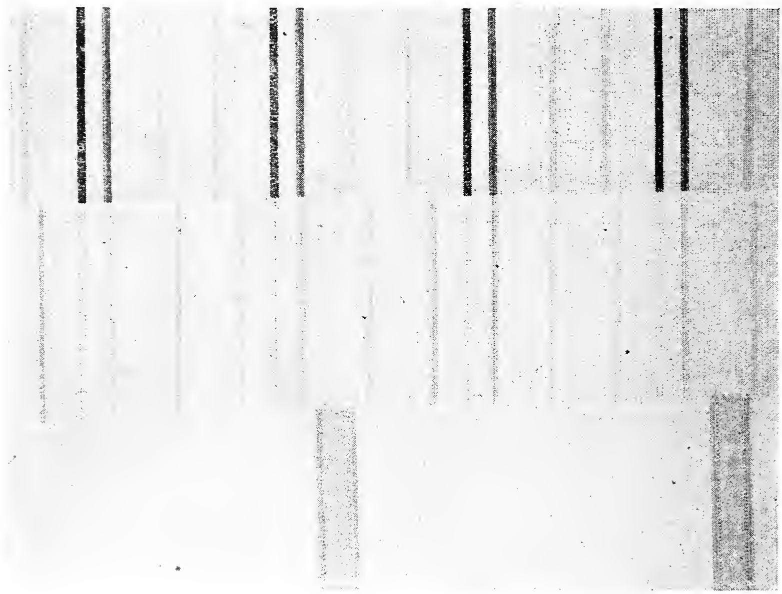
IS NOT TRUE.

The trouble has been when comparing the mercerized fabric that it has not been so heavy in weight or produced of such coarse yarns as the earlier shirting fabrics, and, naturally, would not stand as much hard wear. Of course, the soft twist applied to the filling yarn does render the mercerized fabric a little bit less durable, but not enough to allow any large criticism, especially when similar weights of fabrics are considered.

The newer fabrics are sold largely because of their improved appearance, and because they offer opportunities for the use of fancy weaves which the others do not, and because they can be sold at a reason-

able price which never could be noted on the older style of goods. Not only does such a fabric offer the above opportunity, so far as the weave is concerned, but it also allows yarns of fine sizes to be handled at a comparatively low cost, yarns which were very seldom handled at all in the earlier fabrics for the same purposes, and besides, when they were handled, it was at prohibitive prices, so far as any large sale of the cloth was concerned. Thus it will be seen that competition has developed quite extensively between madras and mercerized shirtings, but only because the sale of the latter eliminates some of the opportunities for the sale of the former, and not because the fabrics as sold are very similar in appearance, because they usually are not. It is quite true that mercerized waistings and similar fabrics have often been purchased in place of silk material, and for this reason, they may be said to offer a certain amount of competition to such lines.

One fact worth noting is that retailers in general have not as yet shown the variety or the adaptability of such material, for comparatively few lines have been purchasable by them up to the present time, and the fabrics which they have obtained in many cases have been styles of which cutters-up bought too heavily and disposed of at second hand. For this reason, the future possibilities of such cloths have not been tried out extensively. Last year saw a large increase in the use of such cloths and the coming year will witness a still greater one. But that buyers have recognized the situation is seen from the large purchases which have been made recently from mills which are able to produce these constructions in fancy weaves.



Three Mercerized Waist or Shirting Fabrics.

In a general way, madras shirtings are made from bleached yarn, and many of them have a somewhat high-

er warp count than they do filling count, while the warp yarn is also coarser in size than the filling, although this variation is usually comparatively slight, while mercerized fabrics are usually made from grey yarns. They also have a higher, or a radically higher, count in the filling than they do in the warp, and the filling is usually a heavier size of yarn than the warp, in many instances being about half as fine. This variation in cloth construction gives a much different cloth when produced and one which is radically different when finished. Besides, the fillings in madras shirtings, which are made from bleached yarns, are comparatively as hard twisted as the warp, so that they can be handled successfully, while for the fabric which is to be mercerized, the filling has a much lower standard of twist, this standard being often less than three times the square root of the yarn size.

Another feature worth noting is that a large number of the mercerized fabrics are made from combed yarns, while the earlier fabrics were and are made largely from carded stock, which gives a cloth that not only is not likely to be so strong but will not be comparable in appearance. Not only does the better yarn used tend to make a more even fabric, but the mercerized cloths, due to the various processes of finishing, lose entirely the reed marks which often make bleached and dyed yarn fabrics very objectionable, but which cannot be eliminated, excepting at a cost which is not desirable. Certain

MERCERIZED FABRICS

are made with carded warp and combed filling, while there are some which are made wholly from carded stock, but the majority of such fabrics, especially those made from medium and fine yarns, are manufactured from combed material. One construction which is used extensively, and which forms the basis for many weaves and stripes, is 64 by 72, with 50s-1 warp and 30s-1 soft twist filling. The fabric which we have analyzed is about this construction in the ground, although a warp of 55s-1 has been used instead of 50s-1.

Another finer construction which is used in many of the higher grade fabrics is 72 by 96, with 70s-1 or finer warp and 40s-1 soft twist filling. These two constructions give a good general idea regarding the yarns used and the sizes which render the best results and also gives a general idea regarding the constructions employed. The soft twist filling is used, because better results can be obtained when the cloth is mercerized. Soft twist in the yarn allows the various cotton fibres to lie more nearly parallel in the yarn, thus reflecting the light and giving more lustre. In a good many fabrics Egyptian cotton is used for the filling, because this material has been found to give better results than other kinds of cotton. Possibly, there is more Egyptian cotton used for filling in fabrics which are to be mercerized than there is in any other one material with the exception of knitted fabrics. Following is the analysis of the fabric considered which contains a dobby pattern with stripes of crowded yarn, and also a plain fabric of a higher construction and with finer yarns.

ANALYSIS NO. 1.

Width of warp in reed, 29½ inches.
Width of fabric finished, 28 inches.
Ends per inch finished (over all) 84.
Ends per inch finished (ground) 68.
Reed 32 × 2.

Ends in the warp $\frac{2}{16}$ 2,288 $\frac{2}{16}$ = 2,352, total ends.

Warp yarn 55/1.
Filling yarn 30/1.
Picks per inch, grey, 72.
Warp take-up, 7%.
Warp weight, grey .0547.
Filling weight, grey .0843.
Total weight per yard, grey .1390.
Yards per pound 7.19.

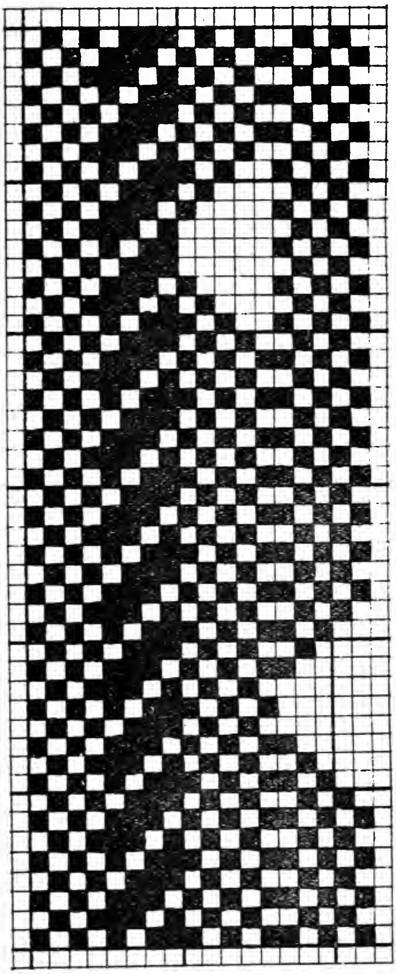
ANALYSIS NO. 2.

Width of warp in reed, 29½ inches.
Width of fabric finished, 28 inches.
Ends per inch finished 72.
Reed 34 × 2.

Ends in warp $\frac{2}{16}$ 1,974 $\frac{2}{16}$ = 2,038.

Warp yarn 70/1.
Filling yarn 40/1.
Picks per inch, grey, 96.
Warp take-up, 6%.
Warp weight, grey .0369.
Filling weight, grey .0843.
Total weight, per yard, grey .1212.
Yards per pound, grey 8.25.

Most of the fabrics which are of the construction described are made on ordinary or fancy looms, and comparatively few are made on automatic machines. This is true partly be-



Weave Diagram.

cause the mills which can produce yarns of the required quality do not contain many automatic looms and also because there is a much greater necessity for having the cloth produced contain few flaws when compared with cheap carded materials. Then it is also questionable whether there is any great advantage to be gained through the use of automatic looms when fine warp yarns are used. In any case, it is at least certain that the advantage which is obtained is not as great as it is on fabrics which are woven from rather heavy yarns. A large portion of the mercerized fabrics are made with fancy dobby or jacquard weaves, and for these weaves the ordinary automatic arrangement is not very adaptable.

In making patterns for these cloths it is almost always the practice to make the figures almost entirely of filling floats. This shows up the figures more prominently, and when the cloth is mercerized the results are more desirable. Sometimes warp floats are used in combination with filling floats so as to bring out certain effects, but they are not used extensively, because the warp is usually of much finer size than the filling and does not show up any effects very well. Stripes are sometimes operated from the same beam as the ground yarn, and this probably has been done in the cloth which we have analyzed. This method can be taken if the weave and threads per dent can be adjusted correctly, but the price of cloth and the demands of buyers often make such a thing impossible, and the stripe must be made from an extra beam. When colored stripes are being produced, even though woven with plain weave, they are practically always placed on a separate beam.

We are giving the drawing-in draft and chain for Fabric No. 1 which has been analyzed. This should be entirely clear, but for various reasons, it may be well to state that the figures in the draft represent the various harnesses on which the warp threads are drawn to produce this pattern. The figures at the bottom of the draft represent the number of threads which are reeded in each dent after they have been drawn through the heddle eyes in the harnesses, while the figures to the right of the draft represent the number of

heddles which are required on each harness, so that the warp can be all drawn in. In fancy cloth mills, harnesses are almost always made up previous to the drawing-in operation, so that it will not be necessary to add any heddles when the warp is partly drawn in, or take them off after the drawing-in is completed.

FINISHING.

As previously stated, the fabric which is being considered is treated in a radically different manner from that used on the ordinary madras or waisting fabrics. In the first place, it is necessary to bleach the cloth because it is in its grey state when woven, and the yarns contain the cotton wax besides the dirt from handling and other foreign material which has to be eliminated before any material can be successfully dyed or finished. Some finishers use the ordinary bleach when finishing such fabrics, while others use the peroxide process, but the method employed is of little importance. The bleaching makes the fabric which is being treated white, but it does not impart any lustre to it. This is done by another process which is called mercerization, from the man who originally discovered the process.

Caustic soda when applied to cotton cloth or yarn causes it to shrink very materially, usually about 20 per cent when the cloth is shrunk as much as possible, but when this is allowed there is no lustre imparted. The lustre is obtained when the material is held out to as nearly its grey width as possible. The cotton fibres, which in their ordinary state are rather flat twisted tubes, seem to swell out and appear more or less like small glass rods when examined under the microscope after they have been mercerized. This smooth appearance reflects the light rays and makes the lustre which is ordinarily noted. By using filling which is soft twisted the

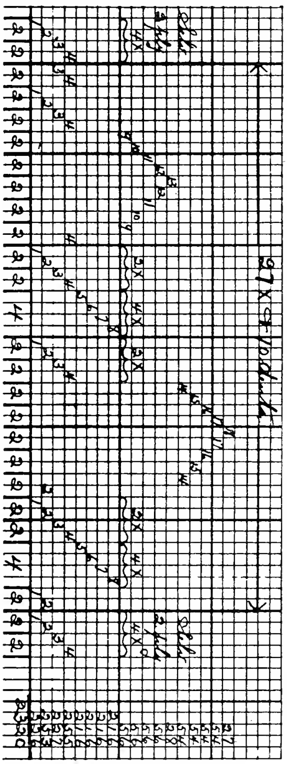
PROCESS OF MERCERIZATION

is aided, for the fibres, as previously stated, lie more nearly parallel in the fabric, although it is possible to impart some lustre to even the shortest cotton fibres, and also when they are twisted harder than ordinarily noted. This will be readily recognized by examining some of the high-class voiles which are now being sold, because the yarns which these fabrics contain are very hard twisted, but even under such conditions it has been found that mercerization adds to their finished appearance, and it is often employed. Various methods are used to obtain the lustrous results which are noted in this class of fabrics, but the main necessity in obtaining these results is to hold out the fabric tightly in the filling direction when it is being treated, and, at the same time, to allow the caustic soda solution to operate. It would naturally be supposed that results would be better if a stronger solution were to be used, but this is not true, and the use of a solution over a certain strength is only a waste of material and adds to the cost. After mercerization the fabric is washed, worked, so as to slip the threads and picks into their proper positions, calendered, folded and handled in any special way necessary, and is then ready for shipment. Quite a little of such material is sold in the white state, but there are also a good many fabrics which are printed or piece dyed in addition to being mercerized.

THE PRICE FOR FINISHING

and applying the mercerization process will vary somewhat, but to-day the quoted price is 1¼ cents a yard, with an allowance of 2 per cent as a working loss in yardage and 3 cents a piece for the so-called silk papers for folders. It often happens when finishing fabrics entirely in the white that this above-mentioned 2 per cent working loss does not occur. The charge for the cases in which the fabrics are shipped is usually about one-twentieth of a cent a yard. When a fabric is to be dyed in addition to bleaching and mercerizing, the price is 1½ cents a yard, and the 2 per cent working loss is almost always noted because of the smaller quantities handled. For printing, in addition to bleaching and

mercerizing, the price is likely to be about 2 cents a yard, although the kind of pattern desired will affect the cost somewhat. In all the above quotations the amount of cloth which is to be finished will affect the prices named for accomplishing it, that is, when a small amount is to be treated, the price is likely to be somewhat higher than when a large amount is to be done. In general, it can be said that the price for this work has decreased quite a little in recent years, and, in addition, the results obtained are very much improved, facts which have in this instance been responsible for cheaper cloth to the consumer.



Drawing-in Draft.

As previously stated, the warp in mercerized fabrics such as those described is usually of rather fine size, but in construction it is no different from the ordinary warp of the same size used in making the usual fancy cloths. For 55s-1 combed warp for cloth similar to that analyzed the cotton used would be 1¼ inches in length. The rolls on the various frames should be set so that in no case will the cotton fibres be broken, for unsatisfactory yarn will result if this is done. The 55s-1 warp might be made either by three or four processes of fly-frames, although it is likely that four processes will give much better and more satisfactory results. Two layouts for such yarn follow one produced from a 35-grain finisher drawing sliver, and with 3 processes of fly-frames and the other for a finisher drawing sliver of 48 grains with 4 processes of fly-frames.

3 PROCESSES, FLY FRAMES.

1 yard of 55/1 =

.1515 grains.
.97 3% contraction in spinning.

.1470
10.27 spinning draft.

1.514 ÷ 2 ends = .757 = 11 hank roving.
6.85 fine frame draft.

5.185 ÷ 2 ends = 2.59 = 3.21 hank roving.
5.75 intermediate frame draft.

14.892 ÷ 2 ends = 7.45 = 1.12 hank roving.
4.70 slubber frame draft.

35 grains finisher drawing weight.

4 PROCESSES, FLY FRAMES.

1 yard of 55/1 =

.1515 grains.
.97 3% contraction in spinning.

.1470
10.27 spinning draft.

1.514 ÷ 2 ends = .757 = 11 hank roving.
6 fine frame draft.

4.54 ÷ 2 ends = 2.27 = 3.67 hank roving.
5.2 second intermediate draft.

11.80 ÷ 2 ends = 5.90 = 1.41 hank roving.
4.4 first intermediate draft.

25.96 ÷ 2 ends = 12.98 = .64 hank roving.
3.7 slubber frame draft.

48 grains finisher drawing weight.

The filling used in such a cloth would probably be made from 1⅛-inch cotton, and the rolls should be set correctly for this length of staple. It often happens that it is necessary to use a longer cotton staple

in making filling yarn which is to be used in cloth that is to be mercerized. Methods will depend somewhat on the machinery being used and largely on the amount of twist which is to be given to the yarn for filling. When the twist per inch is lowered radically, a longer staple of cotton must be used if the yarn spins well in the spinning room, or if it be handled successfully, that is, if it is made on an ordinary spinning frame. One layout for 30s-1 filling which is to be soft twisted and produced with three fly-frame processes and with a 45-grain finisher drawing sliver is as follows:

1 yard of 30/1 =
.2778 grains.
.98 2% contraction in spinning.

.2722
8.45 spinning frame draft.

2.30 ÷ 2 ends = 1.15 = 7.25 hank roving.
6.5 fine frame draft.

7.48 ÷ 2 ends = 3.74 = 2.23 hank roving.
5.57 intermediate frame draft.

20.83 ÷ 2 ends = 10.42 = .8 hank roving.
4.32 slubber frame draft.

45 grains finisher drawing weight.

It is not necessary to state any particular facts regarding the methods which should be used in handling cotton in the early processes of making cotton yarn, for they are well known, and any radical changes from them are likely to result in poor yarn and low quality cloth. The more care which is given to the preliminary processes of yarn making the better will be the quality of the cloth and the price which can be obtained. In no case should a machine be operated at an excessive speed in order to obtain greater production, especially when the fabric which is to be produced is selling for a comparatively high price, and it is very questionable whether on the cheapest fabrics excessive speed results in any great ultimate economy.

DYEING PARTICULARS.

ORANGE.

Toluylene fast orange L X 1½%.
10-30% Glauber's salt crystals.
1-2% soda ash.
Enter at the boiling point and work with the steam turned off.

RED.

Benso fast eosine B L 2%.
20-60% Glauber's salt crystals.
1-2% soda ash.
Enter at the boiling point and work with the steam turned off.

BLUE.

Oxamine blue 3 B M ¾%.
10-20% Glauber's salt crystals.

YELLOW.

Stilbene yellow, 2 G P extra cons. 1%.
10-20% Glauber's salt crystals.

PINK.

Benso fast eosine B L ½%.
20-60% Glauber's salt crystals.
1-2% soda ash.
Enter at a rather low temperature and warm up rather slowly. The Glauber's salt is added subsequently and in several portions.

HELIOTROPE.

Benso fast heliotrope ½%.
10-30% Glauber's salt crystals.
1-2% soda ash.
Enter at the boiling point and work with the steam turned off.

BROWN.

Cotton brown G 2 ½%.
10-20% Glauber's salt crystals.

RAMIE-LINEN

There is one fabric which deserves mention at the present time, not because the construction is especially new or intricate, but because of the adaptation of the cloth to obtain a certain end. This cloth is what is generally known as Ramie-Linen. The name of the fabric is used to give added selling ability, and many consumers would be led to believe that it was composed of something else besides cotton, possibly that it was linen treated in a different manner from that ordinarily noted. This method of naming a fabric does not permit the obtaining of as high a price as could be obtained if the fabric were linen and a consumer was certain of it, but it does make it possible in a great many cases to obtain a higher price than if consumers were sure it was composed of nothing but cotton. Not only has this fabric been given a very deceptive name and one which should not be possible to use for such a fabric, but it has also been constructed in a similar manner so far as its yarns are concerned and

also finished in such a manner as to appear exactly like a good many of the coarse linen cloths.

Undoubtedly, there will be a great deal of such material sold by retailers as linen, not because they have any intention to offer low values but because of general conditions which apply to this particular fabric, for in some cases it is entirely probable that retailers will not know that such a cloth is made from cotton. As a general statement, it can be said that there are no such wide variations in price on such a fabric as that considered as would be noted on the more expensive materials, due to conditions of making, but the selling of such merchandise affects that class of consumers who can least afford to suffer any losses through mistakes in purchasing fabrics at a comparatively high price and under deceptive conditions. A small additional profit per yard on a coarse fabric makes a great difference in the ultimate profit secured, for the production and distribution is large and profits are secured from such features rather than from extremely high prices.

Fabrics such as that described are used for dresses, waists, coverings, in fact, for practically all the purposes for which similar grades of linen would be suitable. These fabrics have been produced by mills in the grey state and they are sold to converters who have them finished in the manner which they desire, and it is very likely that the mills which have made the cloth have not received any great additional profit over that which would have been noticed recently because these fabrics have been in demand. It is probable that mills have obtained anywhere from $1\frac{1}{4}$ to $1\frac{1}{2}$ cents per yard profit on these cloths, but this is high and does not indicate conditions which apply generally to this class of cloth making. Of course, the above named profits will return a handsome dividend to any mill producing them, but it is among the subsequent sellers that variable prices are developed when any are noted.

As a fabric this material is rather coarse and made from very heavy sizes of yarn, the threads and picks per inch being comparatively few in number. Not only are the yarns heavy, but they are also very irregular, in fact, the more irregular they are, the more desirable the fabric is to buyers when it comes to be finished and sold as they are in imitations of linens. In a good many cases the yarns are made from waste obtained in the making of better yarn, and the fabrics are no different from ordinary Osnaburgs or crashes, that is, if they were distributed through other channels.

In fact, many converters have purchased the above fabrics and used them for imitation linens. In practically all instances these cloths are woven with plain weave, because this weave, together with the kinds of yarn used, gives by far the best results, as it shows up the irregularities in the woven fabrics and makes the finished article more salable. Fabrics such as that described, that is, made with coarse yarn, and a comparatively small number of threads and picks per inch and woven with a simple weave should be produced on some kind of an automatic loom. This method allows a weaver to operate a greater number of looms, and decreases the cost of production quite radically, possibly not as large an amount per pound as on finer cloths, because a loom produces a larger poundage, but, nevertheless, a large enough item to make a great difference in the profits secured. The irregularity of the yarns composing the fabric tends to make it firmer than it otherwise would be; that is, with a plain weave and a certain size of yarn the count of the cloth would have to be higher with smooth round yarn than it would with irregular yarn, such as is noted in this fabric or in other novelty cloths which are selling at the present time.

This is one of the comparatively few fabrics where uneven and cheap yarn is rather desirable, and, naturally, machinery is worked as hard as possible, not only because it gives greater production, but also because it tends to make the yarn uneven. Even in making yarns as coarse as those considered and of as poor quality, it is still necessary to keep as many machines in operation as possible, and

have the organization correct, for only in this manner can costs be kept as low as possible.

ITEMS REGARDING PRICE.

As we previously stated, this cloth is one of the coarsest produced and naturally the selling price is low. A good many of these materials which are sold for use as linens have been sold at 36 inches wide in the grey state, and when finished they are about 2 inches narrower, or 34 inches. The mill selling price for the fabric which we have analyzed was 7¾ cents per yard, for 36-inch wide cloth, or about 24¾ cents per pound, on a poundage basis. This price should return good dividends to the mill, for the cost of making this sort of fabric is not much over, if it is any over, 20 cents per pound, thus leaving the mill about 4¾ cents per pound profit, or nearly 1½ cents per yard, an amount which even a fine and fancy mill will seldom average for profits.

One interesting feature regarding the cloth is that the material or cotton of which it is composed forms quite a large proportion of the cost of making, in many instances, it being over 75 per cent of the total cost, leaving the remainder for the various items of expense, depreciation, labor, etc. The labor cost per pound is a comparatively small amount, because the average production per operative is quite large. The cost of having this fabric finished is 1¾ cents per yard and together with the expenses of selling, etc., which a converter would have, the cost to him would be probably about 10½ to 11 cents per yard. Under this condition the selling price to the jobber would be about 15 cents and from the jobber to the retailer, about 16½ cents per yard, thus placing the fabric easily in the 25-cent class to consumers.

A good many sellers have sold such fabrics at the above prices, but retail prices do not always coincide with those planned when the cloth was bought from the mill, because retail prices vary in certain instances to as high as 32 to 35 cents per yard for fabrics which appear identical with that which has been analyzed. Apparently, the consumer is sometimes paying from 25 to 40 per cent more than should be noted, in addition to the satisfactory profits which the various sellers are obtaining when the fabric is sold at the intended price or 25 cents per yard at retail.

CLOTH WEIGHTS.

As previously stated, fabrics which are used for the purposes described, are rather heavy in weight, because the sizes of yarn used are heavy, and it is seldom that the cloth weight is lighter than 4 yards per pound, or 4 ounces per yard, for 36-inch wide goods. We will not consider the weights of either the yarn or the cloth when the material has been finished, because at that time the weights are not the same as when the cloth is woven, and the weight is not considered by any of the various buyers or sellers, with the exception of the converter or buyer who purchases or handles the goods when they were first woven. The warp yarn sizes 8-1 when it is woven and the filling sizes 9.5-1 The details for the cloth are as fol lows:

Width of warp in reed 37½ inches.
Width of cloth, grey 36 inches.
Width of cloth finished 34 inches.
Ends per inch finished 35 inches.
Reed 32 × 1 or 16 × 2.
Ends in warp, 1,208, total.
Warp yarn 8/1.
Filling yarn 9.5/1.
Picks per inch 26.
Warp take-up 5%.
Warp weight, grey .1892.
Filling weight, grey .1222.
Total weight per yard, grey .3114.
Yards per pound, grey 3.21.
The fabric as sold, 5 oz. per yard.
Plain weave.
Selvages, 8 crowded ends each edge of the fabric.

The warp yarns which compose a fabric such as that analyzed are usually sized quite a little so as to make better work in the weave room, and, in some instances, to give weight to the fabric. Probably the ordinary amount of size as applied to a fabric of this character would be from 7½ to 10 per cent, thus making a yarn which had a size of 10s-1 on the spinning frame then come about 9s-1 as it enters the loom. The operation of the loom is likely to rub off some of the cotton fibres and size, and this

makes the yarn somewhat finer than it was on the loom beam, but not so fine as when first spun, so that the cloth is somewhat heavier than the spinning frame yarn sizes would indicate.

A good many manufacturers allow for this added weight when arriving at their cloth weights, while others do not. If some such arrangement is not used, the cloth weights as sold will be heavier than other manufacturers are delivering. The size which is applied is entirely washed out when the material is bleached, and unless more is added in the finishing process, the cloth is lighter when sold than it is when woven. In addition to the loss due to size, there is a stretching and pulling of the fabric which usually makes it lighter per yard, and besides there are losses caused by the bleaching process.

There are also other factors which affect the cloth losses, and in exceptionally few cases cloth gains, such as the kind of cotton used, the amount of twist which the yarn contains, the cloth construction used, the method of finishing, and the kind of dyestuff used. Short cotton will cause greater losses than longer staple, a soft twist yarn will lose more than a hard twist one, and there will be more friction and a greater resulting loss in a firmly constructed fabric than one where there are few threads and picks per inch. Mercerization and other details of finishing also affect the result, and dyeing is likely to add somewhat to the weight, although in cotton finishing results these changes are in no case comparable to those noted when other materials are being dyed. There are other conditions which may at times affect the results, so that the same fabric or the same yarn when finished may appear to have been entirely different when first made, whereas their changed appearance is due entirely to the processes through which they have gone.

FINISHING.

The first step in the finishing of a fabric such as that considered is no different than that employed on very many other similar fabrics which are to be used for dress goods, for they are bleached and handled in a manner similar to that ordinarily employed in bleaching. After the cloth has been bleached, instead of being sold in this condition, it is subjected to a process of mercerization, and this is the method by which the glossy appearance is imparted and which makes it possible to use the material in imitation of linens.

How much the mercerization process has improved in results and the influence it is exerting generally on a great many classes of fabrics is clearly shown by the fabrics analyzed. Only a comparatively short time ago, mercerization was not applied to yarns or fabrics made from short staples of cotton, for the results were not especially good, but it is now seen that the poor results were not caused so much by the short fibres not mercerizing as it was because there was so much twist placed in yarns which were composed of short fibre cotton. This large amount of twist, which was necessary to give the yarn strength, detracted a great deal from the lustre which could be imparted, because the fibres did not have their parallel position by which the greatest amount of lustre was imparted. When a yarn is soft twisted a longer staple of cotton is used and this allows the fibres to lie more nearly parallel, so that it was practical rather than theoretical difficulties which made the mercerization process undesirable, excepting for the better cloths, a short time ago.

Not only has the process been improved greatly, so that results are good even on low quality of cloths, but the costs of application have declined quite a little, so that this fact makes it possible to apply the process extensively, whereas the price alone a short time ago prohibited its use somewhat. Note the cost which we have given in arriving at the cost of the goods. This is $1\frac{3}{4}$ cents per yard and it includes bleaching, dyeing, mercerizing and the other processes which go to make a finished fabric such as that described.

Expensive finishing processes are not often available for the cheaper grades

of fabrics, for they place them in a higher range of prices, for which they cannot always be sold, and in any case curtail their distribution quite extensively. Sometimes, in finishing, starch is added to give fullness to these fabrics, but when this is done, some kind of a softener is also applied to give the cloth the soft effect desired. A light calendering is sometimes used, although it is not especially necessary when the fabric has had a good mercerization process. As a general statement it can be said that the application of finishes to fabrics and the combination of weaves and stripes to make desirable finished materials have improved very much during the past five years, which is a good indication regarding what the future of the industry will be. A good many converters are just beginning to realize the possibilities of the various fabrics, and the methods of finishing which are available, and the results have been surprisingly good when comparisons are made.

YARNS.

The yarns used in these cloths are very uneven, in fact, the more irregularity they show, the better is the cloth produced, so that it might be said that the making of the cloth lies largely in the yarns which are used in weaving it. The cotton staple used is likely to be short, about the shortest which is obtainable in the domestic market, and often waste of various kinds is used to make the yarns produced more uneven. Inasmuch as uneven results are desirable, it is often advisable to crowd the machines up to the limit of their capacity, although even for this kind of work, there is a limit beyond which it is uneconomical to go in the making of any yarn, that is, it would not be a good policy to have the yarn so poor that the percentage of production on the loom is very low, because weaving is an expensive process.

The mixture of short waste does not draw like the other cotton, and helps in making uneven roving and yarn. The sliver can be run heavier than it can even for ordinary cloths such as prints, sheetings, etc., and possibly a 70-grain finisher sliver could be used satisfactorily. It might also be possible to cut out one of the processes of roving frames and make the yarn on two processes instead of on three, as is ordinarily noted. In some cases, it is entirely possible and probably more economical to use single roving for spinning, for the yarn is heavy and should cause little trouble even if it is not as strong as it naturally would be for the sizes of yarn used. The finished hank roving which is used on the spinning frame might be from 1 to 1¼, for this would tend to develop a more irregular fabric than if more doublings were used.

In making such yarns as those considered there is as little waste as possible taken out in the various machines through which the cotton passes for short fibres, and bunches are of decided advantage instead of being objectionable as they are in ordinary yarns. The main idea in the production of any uneven fabric such as that considered is to get the cotton into a workable yarn of the size desired in as quick and cheap a manner as possible, and the plan of production should be made accordingly.

DYEING PARTICULARS.

ORANGE.

Toluylene Fast Orange L X 1½%.
10-30% Glauber's salt crystals.
1-2% soda ash.
Enter at boiling point and work with the steam turned off.

RED.

Benso fast eosine B L 2%.
20-60% Glauber's salt crystals.
1-2% soda ash.
Enter at boiling point and work with the steam turned off.

BLUE.

Oxamine Blue 3 B M ¾%.
10-20% Glauber's salt crystals.

YELLOW.

Stilbene yellow 2 G P extra cons. 1%.
10-20% Glauber's salt crystals.

PINK.

Benso fast eosine B L ½%.
20-60% Glauber's salt crystals.
1-2% soda ash.
Enter at a rather low temperature and warm up rather slowly.
The Glauber's salt is added subsequently and in several portions.

HELIOTROPE.

Benso fast heliotrope ½%.
10-30% Glauber's salt crystals.
1-2% soda ash.
Enter at boiling point and work with the steam turned off.

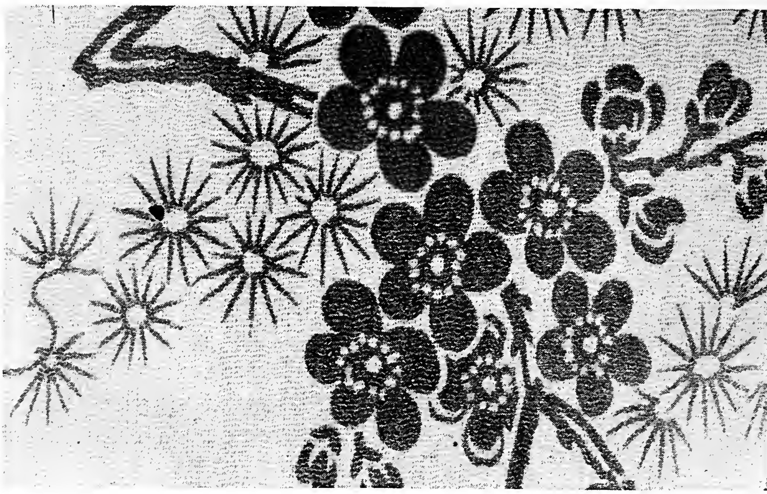
BROWN.

Cotton Brown G 2 ½%.
10-20% Glauber's salt crystals.

CREPE FABRICS

There is a continual change in the styles of fabrics in demand on ordinary cotton dress goods. One year Bedford cords will be used extensively, another season voiles will be stylish, and other years radically different materials will be sold and used extensively, and when such a fabric is in demand, it will be likely to return larger dividends than at other times to cloth makers and sellers. By combining various weaves and styles and producing a somewhat different effect the cloth styles will often last or sell well more than a single season, and this policy is generally taken by manufacturers.

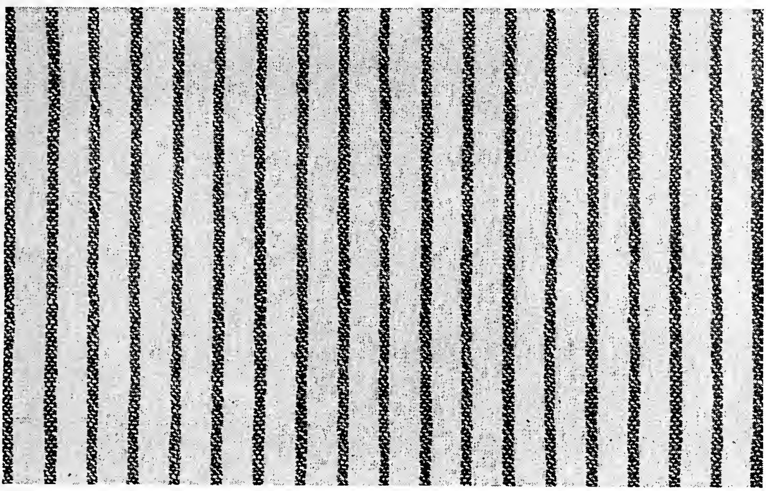
Voiles when first produced did not show the same results which they recently have, and through the addition of silk stripes and a more attractive finish, they have been good sellers for some time. Novelty yarn effects, such as are used in the ordinary eponge fabrics, had been selling well for some time, but this had been accomplished by adding these features to voiles and other ground fabrics. Possibly, the present season there has been a better sale for crepes and crepe effects than there ever has in the past, and for this reason, it may be well to consider certain of such fabrics and their method of production.



Fabric For Which Cost and Analysis Is Given.

In a general way, it can be said that there are many uses for such cloths, and this affords a large production and distribution, not only when there is an exceptional demand, but regularly year in and year out. They are used in the plain state and are also combined with silk and other materials in stripes and checks, for waistings and various kinds of dress materials. In certain instances they are used for men's shirtings, and they are also used in large quantities for the low-priced kimonos, dressing sacques and

other similar articles. The lighter weight materials are the ones which are ordinarily used for dresses, while the heavier fabrics are used for some of the other purposes mentioned. The materials when sold are of a widely different appearance, not only in weight, some being light enough to be used as over-dresses, but also as to the effects produced on them. Crepes have been produced for a long time, not only on the domestic market, but also in foreign countries, and on both power and hand looms, although it is probable that the fabrics now being sold are an improvement on anything formerly produced, at least in cotton cloth. A good many of the high-class crepe materials now being sold are woven with silk stripes, which contain jacquard figures with novelty yarn in stripes and checks, and even in complicated leno fabrics there are yarns used, which, when the cloth is finished, gives a combination crepe fabric.



The Striped Crepe Analyzed.

An ordinary crepe fabric is made with a rather low count, for unless this were done, there would not be opportunity for the yarns to contract and the crinkled effect to be produced. When a fabric is made with a low count, such as is seen on voiles and crepes, it is practically always the case that plain weave is used in their production, inasmuch as this method gives the greatest amount of firmness with the fewest number of threads and picks per inch. Of course, many of such materials are woven on dobby and jacquard looms, but this is not because the ground weave or crepe portion of the cloth demands it, but because of the special weave made necessary to obtain the effects desired.

A good many ordinary crepe fabrics can be and are made on automatic looms, and through such means the cost of production is appreciably lowered. This can be done, because, on the ordinary fabrics, the yarns are rather coarse in size, and, necessarily, strong, and also because plain weave is used, making exceptional ability on the part of the operative unnecessary.

The one fact which is largely responsible for the producing of

THE CREPE EFFECT

is the amount of twist which is given to the filling in the production of such cloth. In a cer-

tain few instances, the warp yarn is made with a small amount of extra crisp, but usually the warp yarn in a crepe fabric is absolutely no different from that of an ordinary fabric. In the production of cloth which is to be piece mercerized, the standard of twist in the filling yarn will be from 2¾ to three times the square root of the yarn size; on ordinary fabrics the twist standard of the filling is likely to be from 3½ to 3¾, while if the filling is to be used for a crepe material, the standard of twist is likely to vary from six to as high as nine times the square root of the yarn size.

This extra amount of twist will make the filling yarn kink up if it is unwound from a filling bobbin, and when a cloth is woven and immersed in hot water, the same effects are noted in the cloth. Because of this shrinkage, it is necessary to set the twist in the yarn so that it can be used in the weaving operation. This is done in a number of methods, depending on the mill system being used, but possibly the method having the largest use is to place the filling bobbins as they come from the spinning frame in a box where they are treated with live steam. This is the process which is ordinarily used for grey, hard twist filling yarn. In order to have the yarn clean and the bobbin unaffected by this steaming process, it is necessary to use enameled bobbins in the spinning room.

HARD TWIST YARNS

will vary in size to a somewhat greater extent than regular yarns, and as there is a certain amount of contraction when spinning, the yarn size is likely to be heavier than the frame drafts and roving size would indicate. Usually changes are made in the drafts of the frames until the resulting yarn size is the one desired. Naturally, when a yarn has an extra amount of twist inserted, it will lose a good deal of its strength, for a yarn is strongest with a standard of about 4½ times the square root of the yarn size, and not only does the above occur, but the production per spindle will decrease radically and this fact affects the cost of production. In ordinary crepes the filling yarn is hard twisted in the same direction as for ordinary filling, only there is a greater amount of twist inserted, but there are other crepe fabrics in which filling is used with both regular and reverse twist. Such kinds of cloth are necessarily woven on a box loom and by far the largest amount of such fabrics is produced with two picks of regular twist and two picks of reverse twist fillings, although quite large quantities are made in which the picking is one of regular and one of reverse twist. When cloth is made from regular and reverse twisted yarns, it can be easily distinguished from that made with only one kind of twist, because in the first instance, there is a regular shrinkage of the cloth with one kind of filling acting against the other in producing the crepe effect, while in the second method the filling all shrinks in the same direction, thus producing a fabric which contains a wavy appearance. Most of the ordinary cheap crepe fabrics are made with filling of only one twist, while a good many of the more expensive lines contain regular and reverse twisted yarn.

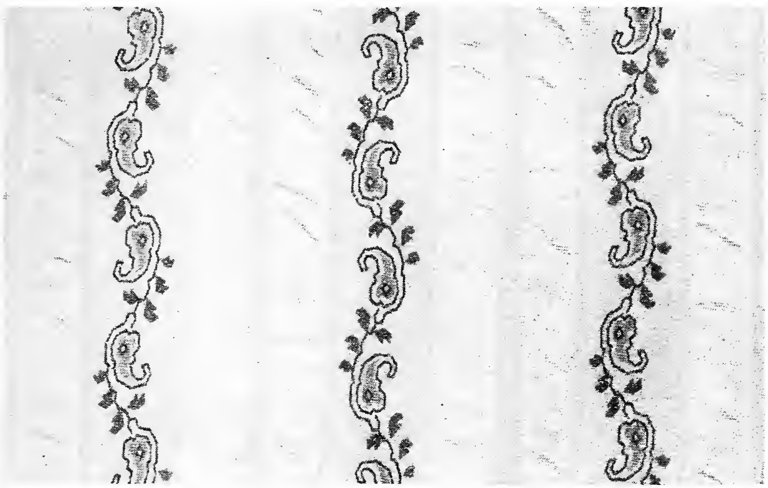
METHOD OF PRODUCING.

There are a great many kinds of crepe fabrics, different not only because of their cloth construction, yarn sizes and woven patterns, but also because there are entirely different methods of production used. First, there is the method by which the majority of ordinary crepes are produced, namely their making from grey yarns. Fabrics made through this method, are often decorated by stripes and checks not only of cotton, but also of silk, and when silk is used a fancy weave is often employed. When these cloths are made entirely of plain weave they can be sold in the white state or any piece dyed color, or they can be printed in almost any style of pattern or colors, and, without doubt, more of the coarser cloths are sold in the printed state than in any other form. For a real crepe fabric, it is cheaper to produce in the grey cloth method than in any other, and this is probably the reason why these cloths form the bulk of the sale.

A second method is to produce the cloth from bleached and dyed yarns, thus producing woven stripes similar in appearance to the styles used in ordinary shirtings. In fact, this method is used extensively when the fabrics are to be used for shirtings. The introduction of fast colors which will stand the bleaching operation is, however, likely to result in fewer of such materials being produced, and it is radically cheaper to-day to make these lines, with the exception of the cloths which contain a large proportion of color by the grey cloth method. There are also a few crepe fabrics which are produced by a method of pressing, but the quantity produced is very small, and the cloth cannot be washed and still retain the effect which it contained, so it is not an actual crepe fabric.

RESULTS OF MERCERIZATION.

Another method of production which might be considered, for it is having a very large use at present, is that which results in making a crinkled effect by the mercerization process. Some sellers class the fabric produced as a crepe while others consider it as a seersucker effect, and while it naturally belongs in the seersucker class, it is being sold as a crepe and in competition with it, and should be included in the general description. A good many sellers have not considered certain of the results which mercerization causes. To-day most sellers are familiar with the fact that a lustre is imparted when cloth is treated with a solution of caustic soda and held out tightly, but they do not always know that cloth treated with the same solution and not held out will shrink radically. Upon the above fact the production of this class of seersucker or crepe is based.



A Crinkled Crepe Produced by Mercerizing Process.

An ordinary fabric is printed with a paste or solution, and where this is applied the fabric will shrink, and one portion of the fabric being treated causes the portion not treated to shrink up or crinkle, producing the crepe effect. Many of such fabrics are sold in the white or colored state, but there are many others which have in addition to the crinkled effect a printed pattern applied, the variety being just about as large as it is for ordinary dress materials. One feature which has to be considered

when such a method is used is that there is a large working loss in the cloth yardage treated, and the amount received by the buyer, and this increases the cloth cost quite radically. Finishers require a large working loss clause in their contracts, but often do not hold themselves to the amount stipulated. Generally, the actual loss in yards received and delivered is from 18 per cent to 20 per cent. The amount an ordinary crepe fabric will shrink in width in the finishing operation is from 25 per cent to 30 per cent, although there is a wider variation than this due to the results desired. The harder the filling yarn is twisted, the greater the amount the fabric will shrink or crepe within reasonable limits, but it is usually the case that the cloth is not finished as narrow as it actually will shrink. Naturally, the warp count when finished is radically higher than it is when the cloth is first woven. It is sometimes the case that certain of the better fabrics are not merely shrunk by hot water, but they are given a processing in caustic soda solution, which method gives them an effect which is otherwise not obtainable, for it makes the yarn softer and adds to the cloth attractiveness.

FANCY PATTERNS.

A good many crepe fabrics are made with warp which is entirely silk, and such fabrics are often decorated with fancy jacquard figures or by stripes of various kinds. The filling used in such fabrics is single hard twist yarns, although in certain instances two-ply filling is used, and in the filling there can be either one direction of twist or the cloth can be woven on a box loom with regular and reverse twisted yarn, possibly the second method is more extensively used in the production of high-class crepes. In the making of patterns for such fabrics there are a number of facts to be considered which makes the problem somewhat different from ordinary work. In the first place, there are only a comparatively few picks per inch in the cloth, and care must be used so that the patterns will show the best results possible. There is also likely to be a certain amount of stretch in finishing, and this should be considered when making the design, for the cloth is sold finished to the consumers, and not in the grey state. The

LARGE SHRINKAGE IN WIDTH,

at least, must be considered, if the other facts are ignored; thus, a fabric which counts, say, 96 threads when it comes from the loom, may count 130, or even more, when it is finished, so that a pattern which is correct for the grey material will be out of proportion when the cloth is finished. For this reason, a good many patterns have to be wider in the grey cloth than they would be in any other case, and do not look right, but when the cloth is finished the correct results are shown. This condition should be regulated on the design paper, which is used in planning the pattern. That is, a fabric might call for a design paper which was 12x7 if the grey count were considered, whereas it would actually need a paper which was 12x5 if the conditions of finishing be correctly considered. On certain of these crepe fabrics, it is true that the shrinkage in count is not so great as the width would indicate, for there is a certain waviness in the cloth which will affect the pattern. Inasmuch as there are so few picks per inch in the woven fabric, care must be used to break up the figures, so that there will be no long floats to make the fabric objectionable. Practically all fabrics are produced with plain weave grounds, so that the making of the design is a rather sim-

ple process. As previously explained, plain weave is necessary, if the fabric is to have a sufficient amount of firmness and if the threads are to remain in their respective positions.

YARNS AND WEIGHTS.

The yarns used in crepe fabrics are of widely different quality and sizes, because the range of fabric quality is so great. Some of the low-priced materials are made with yarns which are not better than those used in the most common materials, and in such cases the yarn production is large and the stock used not of especially high quality. In other materials, fine or rather fine yarns are used and the stock is of high quality and often combed and a good deal of care is used in producing, in fact, more care than is noted on most kinds of fancy fabrics. We present in another portion of this description an analysis with costs of one of the most common crepes sold, but following is an analysis of an imported crepe which contains dyed yarns:

Width of warp in reed, 59½ inches.
Width of cloth from loom, 56 inches.
Width of cloth finished, 44 inches.
Threads per inch, finished, 72.
Reed, 27 × 2.

Ends in the warp $\frac{2}{8}$ 3,200 $\frac{2}{8}$ = 3,232, total ends.

Warp yarn size 40/1.
Filling yarn size 30/1 hard twist.
Picks per inch finished, 47.
Total warp take-up. 12%.
Warp weight, .1093.
Filling weight, .1110.
Total weight per yard finished, .2203.
Yards per pound finished, 4.54.
Plain weave.
Warp dressed 12 ends white, 4 ends black.

The yarns used would be made from roving of similar sizes to those used for ordinary yarn of the same size, except that for fine filling it is better to have roving finer than the yarn size indicated would require, due to the contraction of twist.

A correct estimate should be made of the losses sustained when obtaining the sizes of the original grey yarns used. Take the fabric for which the cost is given. On this the warp in the finished cloth actually sized 39½, while the filling sized about 22½, whereas 36 warp and 20 filling were used. This shows that the sizes are much finer in finished fabrics than many have been accustomed to believe, and this fabric has been printed a fact that is likely to add some weight to the yarn.

THE WARP LOSS

is not entirely due to the bleaching, loss in size, and weaving operation, but a portion of it is due to the stretch which is given the cloth in finishing as can be noted from the picks, 40 when the cloth was in the grey state and 37 when it was finished. Not all of this stretch is actual gain in yardage to the finisher, but, without doubt, the extra amount obtained is at least 5 per cent or 6 per cent. When obtaining the yarn sizes for a crepe fabric which has been produced by the mercerization process, it is a good plan to size the yarn from the crinkled portion of the cloth, for this is the yarn which has not been shrunk below its actual size by the method of finishing used. Note the cloth weights (5.32 in the grey state and 6.10, or about this amount, when finished), which fact shows in a general way what the cloth losses are when this kind of crepe fabric is being produced. The method of obtaining the weights of the yarn used and the cloth weight when woven is as follows:

2,388 ends ÷ (840 × 36/1) = .0790, weight of warp without take-up.
5% take-up in weaving.
.0790 ÷ .95 = .0832, total weight of warp yarn per yard of cloth.

$$\frac{40 \text{ picks per in.} \times 44'' \text{ width in reed} \times 36''}{36''} =$$

1,760 yards of filling per yard of cloth.
1,760 ÷ (840 × 20/1) = .1048, total weight of filling per yard of cloth.
.0832 + .1048 = .1880, total weight per yard.
1.0000 ÷ .1880 = 5.32 yards per pound (grey).

PATTERN.

36/1 Am. carded warp $\frac{2}{6}$ 2,364 $\frac{2}{6}$ = 2,388, total ends.

20/1 Am. carded filling, hard twist, 40 picks.
27 reed, 44" width in reed, 41" grey width, 30" finished width.
58 × 40 grey count, 79 × 37 finished count

YARNS.

	Cotton.	Labor, waste, etc.	
36/1 Am. carded warp, 1⅛" staple, 8 hank double,	15¼c.	8c.	= 23¼c.
20/1 Am. carded filling, 1$\frac{1}{16}$" staple, 4.75 hank double,	13¼c.	6¼c.	= 19½c.

COST.

2,388 ends 36/1 Am. carded warp + 5% take-up = .0832 @ 23¼c.	= $ .0194
40 picks 20/1 Am. carded filling, hard twist = .1048 @ 19½c.	= .0205
Weaving	.0020
Expenses	.0038
	$ .0457
Selling (grey)	.0018
Mill cost	$ .0475
Mill selling price to converter	.0537
Cost of crepeing, bleaching and printing	.0300
Cost of selling, etc.	.0125
Cost to converter	.0962
Cost to jobber	.1125
Cost to retailer	.1300
Cost to consumer	.1800

Yards per pound, 5.32 (grey).
Yards per pound, 6.10 (finished).
Plain weave.

COUTIL OR CORSET CLOTH

In preparing the new edition of our "Cotton Fabrics' Glossary" it becomes necessary to consider many cloth constructions which had not appeared three or four years ago. Improvements in the construction of cotton machinery and the accompanying development which has made possible the use of cotton fibres which were originally considered too short to be of much value have led to entirely new fabrics and to new modifications of old ones.

One fabric which is seldom mentioned as forming any great portion of textile sales, but which nevertheless is of quite large importance, is the general class of fabrics known as coutils. Possibly the production of the above named material is as regular as any of the numerous novelty or special constructions made, and while the weave, count and yarns used will vary, the general character of the cloth does not change as much as it does in other lines.

Dress goods colors, styles, weaves and cloth constructions will vary radically in different years, but, due to certain fundamental necessities, coutils might be called more or less a staple fancy product. Of course, there are different qualities of these materials which sell at various prices, just as in any other lines, but the results are more limited in such fabrics. In general, these materials are used largely in the white state, as there is great objection to dyed goods for such uses. Then there must be a construction used which will give a great deal of strength and wear.

Most users of these fabrics test

THE BREAKING STRENGTH

of the cloth which they purchase, and unless deliveries are satisfactory in this regard there is likely to be a great deal of friction between buyer and seller, and, without doubt, this is the reason why a good many mills do not care to attempt to produce them. Probably the largest portion of coutil production is used in the making of corsets, but it is also utilized in other ways, such as bands for children's garments where there is likely to be a good deal of wear and tear, and in other similar methods, and recently we have been

brought in contact with a firm which claims to export as much as 50,000 pieces a year of a fabric such as that analyzed.

It has been generally supposed that very little of such material was sold outside of the domestic market, for the price is high, and conditions of making are such that the labor costs form a comparatively large portion of the total cost. The use which is made of this exported cloth is one not usually noted, for it is made into white suits of various kinds which receive a good deal of wear, at least this is the use which the exporters claim is made of it. Probably there are not over half a dozen manufacturers in the domestic market who produce a high class coutil fabric such as that analyzed.

CLOTH CONSTRUCTION.

Considered as a fabric, coutils are not radically different from many of the ordinary cloths which are made and sold in enormous quantities. It is the weight and strength and the difficulties encountered in obtaining these that make care necessary. Generally, the weave which is employed is a five-harness warp satin, although it may be some other similar weave. In some instances, jacquard or dobby patterns are employed, but when this is done, it is usually with a satin ground effect, while in special cases certain constructions are made with plain weaves.

The reason a satin or a similar weave is used is because, through such a method, a high cloth count can be obtained, also the requisite strength. Of course, strength can be obtained by the use of plain weave together with heavy yarn, but such cloth would have no sale for corsets, for, in addition to strength, a smooth, good looking cloth is necessary, and the use of a satin weave answers both purposes. Whenever a fabric is made with a satin weave a high count is necessary, so that the cloth will be firm, and although coutils are high-count materials they are likely to be quite heavy in weight. Not only is the warp count high just the same as it is in galateas and similar lines, but the filling count is also high, although it is not usually quite so high as it is in the warp. Although the yarns used are rather coarse in size, when compared with those used in lawns and similar fine yarn lines, they are often made from combed stock, and this fact adds much to the cost of production.

Combed yarns not only produce a better appearing fabric, and one containing a greater amount of strength, but they also make the weaving of cloth an easier problem from a manufacturing standpoint, for the warp breakages are much fewer in number. One fact in weaving such materials is that quality is one of the prime necessities, and many fabrics which are considered seconds in such production would be ranked as firsts were their conditions of selling not so strict. Because there is a good deal of strength necessary it is often the case that ply combed yarns are used in making the cloth, not only in the warp but also in the filling. When this is done, the yarn sizes are naturally finer than when single yarns are used. This method of manufacturing produces a better and stronger cloth, but it increases the cost of making quite radically.

LOOM USED.

So far as the weave and the yarn used are concerned, it might be considered that automatic looms would be suitable for producing such materials, but there are certain other features which, up to the present time, have made it more or less necessary for non-automatic looms to be used. One item is that the weave is likely to vary quite a little in the number of harnesses necessary to produce.

Another is that high quality production is necessary, a condition which is not always true when automatic looms are used, and another is that the ratio of saving made possible by the use of automatic looms is not so large as it is on cheaper ordinary fabrics. A saving of a cent or more a pound is not of so great moment in a fabric which sells for 15 or 20 cents a yard as it is in a fabric which sells for less than 5 cents a yard. Because the cloth is very firm with a high count and rather coarse yarns,

it is necessary for it to be woven on a loom which is much heavier than that used in producing ordinary fancy fabrics. Unless this were done, poor cloth would result and the light loom would be knocked to pieces in a comparatively short time.

WOVEN FACE DOWN.

In making satin weave cloths it is often the practice to weave the cloth face down in the loom, as this makes it necessary for the loom to lift but one-fifth of the warp instead of four-fifths at every pick, that is, if the weave happens to be a five-harness warp satin. A good deal of judgment has to be used in the method which is employed, for it is sometimes better to weave a cloth face up, especially if the weaving is very difficult. Inasmuch as the warp contains a large number of threads of rather coarse yarn, it is necessary to use a great deal of care in the placing of the yarn on the loom beam.

Any irregularities of tension or other features which are of little account in ordinary fabrics will cause very evident streaks and much trouble in coutil fabrics, at least in the high-class ones. It is usually the custom to use a reed in making these materials which corresponds with the fabric weave used. That is, if a five-harness weave is used, the warp will be reeded five threads per dent, and if another weave be used a different arrangement would be made.

This policy will result in less streaks than through any other method, and allows a rather coarse reed to be used, a fact which results in more space being available for the operation of the heavy warp. The choosing of a correct reed has much to do with the satisfactory production of many kinds of cotton cloth. Some manufacturers are inclined to always use a reed which permits two ends per dent just because the lines of cloth which they have regularly produced are made in this manner, but it often happens that when a mill's cloth constructions vary widely other methods are better on certain fabrics. Sometimes it is necessary to use a coarse reed, because yarn knots on heavy material will not pass through without breaking. In other cases, a high warp count and with a reeding of two in a dent will cause excessive friction and breakage, with a low percentage of loom production. Then in certain other fabrics the use of a coarse reed with quite a number of ends per dent is often objectionable, because in finishing the reed marks cannot be entirely taken out. One reason why grey yarn fabrics look much smoother than similar yarn bleached, or dyed materials, is because one is likely to contain very evident reed marks when sold, while the other is not. One problem which often causes a great deal of trouble when coutils are being produced is the construction of the selvages. When these are made from the same warp as the ground of the fabric, it is very likely that unless the right number of threads per dent are used the edges will curl up or will not appear smooth like the body of the fabric, and will cause a large amount of criticism.

Because of the uses of the fabric being considered it is not necessary in many instances to have any decoration applied to the fabric so as to make it more attractive. Whenever such decoration is desired, it is usually applied by methods in the weave rather than by dyeing or printing, but in the large majority of instances the cloth is sold in the white state and with a comparatively simple weave. Naturally, the above conditions make the operation of finishing a rather simple one, for all that is necessary is to bleach the cloth and handle it in a similar manner to that on fabrics which are sold in the white state.

Many ordinary fabrics when sold are also sized or starched a good deal, and some of the cheaper lines are filled with clay or some similar substance, but the firmness of coutil fabrics makes this largely unnecessary. Most of these fabrics have a somewhat higher count in the warp than they do in the filling, for this makes possible a larger loom production and a corresponding decrease in the cost of making. The price of such materials is very high per yard when com-

pared with others which have about the same weight, but this is caused by the use of combed stock, the large number of threads and picks per inch and the rather small loom production. It is also true that the cost is high, because more care is necessary in weaving, and fewer looms can be operated per weaver than on the similar weight ordinary fabrics. The cost of finishing will depend a good deal on the conditions governing the fabric, that is, a small order may have a high cost, while a larger one will be lower. There is this advantage, however, in coutils in that the order is usually finished entirely in the same method, there being no different colors or printed patterns. In general, the price is somewhat similar to what it is on other fancy white goods which are only bleached.

As previously stated, the yarns used, when single, are quite coarse in size, but they are often combed, and so manufacturing processes are somewhat different from those usually noted. Coutil cloths are made largely by fancy mills, ones which have an equipment capable of producing a wide range of fabrics, and so the yarn problem is not an especially difficult one. Naturally, when combed yarns for cloth are being produced it is likely that the staple will be as short as can be conveniently handled on a comber, and in most mills one and one-eighth inches is the shortest fibre which can be combed. Because the roving necessary is so coarse, it is customary to use shorter drafts than when ordinary yarn is being made, for this aids in making a better yarn. For the two yarns used in Fabric No. 1 the layout would be somewhat as follows:

30/1 warp.
.2778 grains = 1 yard.
.98 2% contraction in twisting.

.2722
9.5 spinning frame draft.

2.58 ÷ 2 = 1.29 = 6.46 hank roving.
6.25 fine frame draft.

8.06 ÷ 2 = 4.03 = 2.06 hank roving.
5.25 intermediate frame draft.

21.16 ÷ 2 = 10.58 = .79 hank roving.
4.25 slubber frame draft.

45 grs. finisher drawing sliver.

24/1 filling.
.3472 grains = 1 yard.
.98 2% contraction in twisting.

.3403
7.58 spinning frame draft.

2.58 ÷ 2 = 1.29 = 6.46 hank roving.
6.25 fine frame draft.

8.06 ÷ 2 = 4.03 = 2.06 hank roving.
5.25 intermediate frame draft.

21.16 ÷ 2 = 10.58 = .79 hank roving.
4.25 slubber frame draft.

45 grs. finisher drawing sliver.

It will be noted that we have planned the drafts for warp and filling so that both can be made from the same size of fine roving, and while this policy makes the spinning draft for filling somewhat shorter than it otherwise would be, it probably is a good plan to adopt such a method. The spinning drafts for both warp and filling can be increased somewhat, and the roving draft decreased to correspond, with very little difference in the quality of the yarn produced. In some cases, it is not possible to make warp and filling from the same size of roving because different stock may be used for the various yarns, and the sizes may vary so widely that either yarn may show some excessive draft, a condition which is not desirable for practically all kinds of yarn making. Machinery organizations and mill working conditions often make it inadvisable to change certain yarn schedules which in other instances would be more desirable, and there is no definite set rule as to just the exact means for producing the best results on any single yarn.

The method of obtaining the yarn weights and the yards per pound of the woven cloth is a very simple process, because there are no stripes used or complicated methods of making, neither is there any great change from grey to finished materials, a fact which is not noted on a good many of the ordinary fabrics. Following are two layouts for radically different coutils, one made from single yarns and the other from ply yarns:

FABRIC NO. 1.

Width of warp in reed, 30½ inches.
Width of cloth grey, 28 inches.
Width of cloth finished, 26¾ inches.
Ends per inch finished, 148.
Reed 26 × 5.
Ends in the warp, 3,964 total.
Warp yarn 30.5/1.
Filling yarn 24/1.
Picks per inch, 96.
Warp take-up, 9%.
Warp weight per yard, .1700.
Filling weight per yard, .1453.
Total weight per yard, .3153.
Yards per pound grey, 3.17.
Five harness warp satin weave used.

FABRIC NO. 2.

Width of warp in reed, 30 inches.
Width of cloth grey, 28 inches.
Width of cloth finished, 27 inches.
Ends per inch finished, 145.
Reed 26 × 5.
Ends in the warp, 3,936 total.
Warp yarn, 70/2.
Filling yarn, 70/3.
Picks per inch, 92.
Warp take-up, 10%
Warp weight per yard, .1488.
Filling weight per yard, .1408.
Total weight per yard, .2896.
Yards per pound grey, 3.45.
Five harness warp satin weave used.

The cost of making the second fabric given is much higher than for the first one, mainly because the yarns are much finer in size when spun, and this requires a longer and higher priced cotton, and a good deal higher labor cost and expense in spinning, and in addition, there is the charge for twisting and the extra cost of handling, especially on the price of filling, a cost which would not be noted at all if single filling had been used. So far as the weaving cost item is concerned, the difference in the two fabrics is not very wide. The method of obtaining the yarn and cloth weight for Fabric No. 1 is as follows:

3,694 ends ÷ (30½/1 × 840) = .1547, weight of warp without take-up.
9% take-up in weaving.
.1547 ÷ .91 = .1700, total weight of warp per yard of cloth.

$$\frac{96 \text{ picks} \times 30\tfrac{1}{2}'' \text{ reed width} \times 36''}{36''} = 2{,}928$$

yards of filling per yard of cloth.
2,928 ÷ (24/1 × 840) = .1453, total weight of filling per yard of cloth.
.1700 + .1453 = .3153, total weight per yard.
1.0000 ÷ .3153 = 3.17 yards per pound (grey).

CREPE DE CHINE

One fabric which has had a more or less regular sale but which has of late been of especial interest to manufacturers and sellers is crepe de chine. Naturally, when this fabric is mentioned an all-silk material is brought to mind, but there are also cotton and silk, mixed fabrics which bear this name, and at certain times, even all-cotton fabrics have been so designated, by the retailer at least. Inasmuch as these fabrics hold such a large place in regular distribution a few facts regarding their appearance, construction and method of making may be of interest. All the materials which are known as crepe de chines have a comparatively light weight, and are clinging fabrics which are very desirable when soft effects are in style.

These fabrics are used extensively for dresses, waists, trimmings, overdresses and similar purposes where practically no other cloth fills the purpose so well. Prices for making are likely to vary quite widely, due to conditions in the market for materials and largely due to the demand for the goods. Generally, the prices for most of the all-silk fabrics at retail will be from $1 to $1.50 per yard, although these prices in no way express the possible variation.

SILK AND COTTON MIXTURES.

The silk and cotton mixtures will also vary according to their construction and the market selling conditions, but usually the price will be from 25 to 50 cents a yard for ordinary materials. The price for all-cotton fabrics is largely dependent upon the stripes or other decorative cloth features, of which there are many. More often the all-cotton cloth is not called crepe de chine, but is simply designated as crepe, which is a much better name to use, as it more definitely expresses to consumers and others the materials from which it is made. The name crepe de chine has, however, come to be more or less a term which designates a method of constructing a cloth rather than the materials of which it is made, for we have quite often seen all-silk crepe de chine which could hardly be distinguished from some of the higher classes of cotton crepe, at least by a good many consumers.

In all-silk fabrics, the cloth construction will vary widely. Some of the warps are drawn in two-ply, that is, two threads work as one in the weaving operation, while others are drawn in single. One fabric which has been analyzed has a finished warp count of 280, with two threads used as one, thus making the warp count appear like 140 in the cloth, with 94 picks per inch, another has a warp count of 220, with the threads drawn singly and with 80 picks per inch, and still another has a warp count of 125 threads and with 76 picks. The number of the threads and picks per inch affects the result when finished somewhat, for if a count which is too high is used the fabric will not have the soft effect which is so desirable. This does not mean, however, that a low construction is entirely suitable. In practically all of these fabrics the lustre is imparted by the warp yarns. For this reason, the warp is likely to be of better silk than the filling, and not only better but also of finer size and of a higher number of threads per inch. The reason why the warp gives the cloth lustre is as follows:

To make the soft and crepy effect the filling yarn both in the all-silk and in the silk-mixture fabrics is twisted harder than for ordinary cloth. The hard twisting of any yarn will so curl up the fibres that they will not lie parallel and so will not reflect light and give lustre. It is in the yarn which is twisted the least that the greatest sheen appears, and so when the filling is hard twisted the opportunity for lustre from it is either partially or wholly destroyed. The filling is hard twisted rather than the warp, because this is the most economical method of making.

Hard-twisted warp would be the cause of untold trouble, for it would make the percentage of production in weaving very low, create many seconds, and when the cloth was finished would entail a radical loss in yardage, thereby increasing the cost of making. Filling yarn has to be handled much less than warp, and for this reason, it is more economical to make hard-twist filling than it is warp.

In all varieties of crepe fabrics there are two kinds of effects which can be produced with practically no change in the sizes of yarns used or in the method of construction, and which are easily distinguished even by the ordinary consumer. These are first the ordinary crepe de chine cloth, and second, the ones often designated as crinkle crepes. The standard of twist or the turns per inch in the fillings of these two fabrics are often identical, and the warp counts often the same, but the differences are produced by the direction of twist which is inserted in the yarn.

A crinkle crepe has filling in which only one twist has been applied, and it matters very little which direction of twist is used so long as it is all in the same direction. Crepe de chines are woven with filling which has two kinds of twist, regular and reverse. This fact makes it necessary that the cloth be produced on a box loom which can insert first one or more picks of yarn twisted in one direction and then insert yarn twisted in the opposite direction. In the large majority of instances when two directions of twist are used the filling is placed in the cloth two picks in one direction and two picks of filling twisted in the opposite direction.

These two twists react against each other, thus making the regular crepy appearance in crepe de chine, whereas when but one direction of twist is used the filling all twists in the same direction, making waves, or the so-called crinkle crepe effect. Because the filling is hard twisted and more or less irregular in appearance, it is often the case that schappe filling is used so as to make a lower cost of production, and it is also a customary proceeding to use a hard-twist Canton silk for filling, whereas in the warp organzine silk is used.

It is just as important in manufacturing crepes of any kind not to get the amount of twist excessive as it is not to get the twist high enough, for too much twist will cause excessive irregularities and add appreciatively to the cost of producing, and besides will cause excessive shrinkage in the cloth width. One feature

regarding crepe fabrics is that the width of the cloth as it comes from the loom is much wider than it is when finished. That is, an all-silk fabric may be from 15 to 20 per cent narrower when finished than when woven, while a silk and cotton mixed fabric may have a little greater shrinkage, or from 20 to 25 per cent. These foregoing figures are only general ones, and special instances may be noted where they are exceeded, but they apply to very many crepe de chines and also to similar crinkle crepe fabrics.

YARNS.

As stated previously, the kind of yarns used and the amount of twist inserted is largely dependent on the cloth results which are desired and the price at which the cloth can be sold. A fact which enters into the cost of making crepe fabrics, but which is not always considered as carefully as it might be, is the contraction in the filling yarn, due to the hard twisting operation. This process makes silk yarn heavier in size, and, therefore, have a smaller yardage per pound, and this naturally increases the cost of the cloth in which such yarn is used.

The harder the yarn is twisted the greater the contraction is likely to be. Accurate tests should be made on the yarn previous to the weaving operation, so as to obtain as near as possible the average yardage in the filling yarn. When silk mixture materials are being made, the filling is usually, although not always, combed yarn. Inasmuch as cotton yarn is much heavier in size than silk, the variation due to the contraction in twisting is somewhat more evident, but because the cotton cost in such cloth is a comparatively small proportion of the total cost, the variation does not greatly affect results, yet in any accurate estimates, the shrinkage should always be considered. Some cotton manufacturers regulate their roving weights and drafts so as to have their finished yarn the exact size desired, while others take a different policy and use regular roving sizes, allowing the yarn to contract, and then to use for figures the yarn size which is actually obtained by weighing.

With silk yarn the problem is one very similar to that in these last-named cotton mills, where an allowance in size is made for the shrinkage due to the twist. The hard twisting of yarn also affects the cost of production, because the amount produced is smaller than it would be under normal conditions. On silk yarns the percentage of increase on the total cost is not so great as for cotton yarns, because the original silk cost forms such a large proportion of the cost of silk yarn. For a filling of 40s-1 the cost of spinning or hard twisting, including all the various items, would be from 12½ to 15 cents per pound, or about twice as high as it is for ordinary warp yarn of the same size.

The standard of twist which is applied for cotton yarn for use in crepes is likely to be about seven and a half to eight times the square root of the yarn number, but there are cases where the standard is as low as six and as high as ten, or even higher, although the excessive twist does not seem to be of any great advantage in producing a better cloth effect. A greater amount of twist increases the cost of making and weakens the yarn, because, as the standard of twist advances over 4½ to 4¾, the breaking strength of a yarn will decrease. Hard-twisted cotton yarn is also likely to cause a good deal of trouble in the spinning room, because the yarn acts more or less as a saw, and will cut through the travelers so that they will have to be renewed quite frequently.

TYPICAL ANALYSES.

One silk fabric which is an attractive material is actually constructed as follows in the finished state:

Cloth width finished 40".
Warp count 280 threads per inch.
Warp drawn double.
Filling count 94 picks per inch.
Warp size 128,500 yards per pound.
Filling size 138,800 yards per pound.
Warp probably 2 thread 13/15 organzine.
Filling probably 26/28 Canton (hard twist).
Threads in the warp 11,296.
Weaving take-up 3%.
Width in reed about 48".
Warp weight finished .0906.
Filling weight finished .0325.
Yards per pound finished 8.12.

It is a well-known fact that silk yarn when first purchased contains a varying amount of gum which holds the fibres together and which is not apparent on examination. When boiled out, all or nearly all of this gum will disappear, leaving the yarn lighter in weight than it was when purchased. To make silk fabrics heavier and to appear better it is a customary proceeding to add weight when yarns or cloths are dyed, so as to more than offset this loss in gum, in some cases enough weight being added to render the service of the cloth rather short. In the sample analyzed the amount of weighting added accounts for the difference between the silk yardage in the cloth and that which the yarn size used would indicate when the yarn was first purchased.

COTTON AND SILK MIXTURE GOODS.

Cloth width finished 27".
Cloth width grey 36".
Warp count grey 97 threads per inch.
Warp count finished 129 threads per inch.
Filling count grey 68 picks per inch.
Filling count finished 66 picks per inch.
Warp size 185,000 yards per pound.
Warp size 22/24 Italian silk.
Filling size 40/1 hard twist cotton.
Threads in the warp 3,500.
Take-up in weaving 10%.
Reed width 37".
Warp weight grey .0210.
Filling weight grey .0749.
Yards per pound grey 10.43.

One of the New Crepe de Chine Fabrics.

In the foregoing analysis the warp yardage has been assumed as 185,000 yards per pound, and this figure is somewhat coarser than the yarn figures would indicate, but it is done as a protection for variation in silk size, and is a customary proceeding when cotton mills are making silk mixture fabrics. One fact of interest is that the yarn size and the weight of silk in cotton mixture fabrics are usually quite a little lighter than when woven, for the silk gum has been removed and no large amount of weight added to make up for this loss. On entire silk goods the difference is that the yarn and cloth is usually heavier in the finished state, for weight has been added to more than make up for the loss of the gum.

FINISHING RESULTS.

In general, it can be said that most all crepe de chines and crinkle crepes of the class described are piece-dyed fabrics, not only when composed entirely of silk but also when partially made of cotton. Probably a much larger proportion of crepe materials is made in the crepe de chine method than in the crinkle effect, and plain weave is employed in a large number of the fabrics. This does not mean that fancy weaves are not

used in quite a good many of such materials, for they are, and with an additional attractiveness in the result obtained. Both dobby and jacquard effects are used, although care has to be exercised so that in the result finished the proportion of the figures will be correct.

In a good many fabrics, especially those made partially from cottons,

SILK STRIPES

are introduced with advantage, and often make possible a better mill dividend. Because the filling is hard twisted, it is the usual custom to make all woven figures from the warp yarn, as this portion of the cloth is lustrous and produces a contrasting effect when compared with the ground fabric. The method of obtaining the yarn and cloth weights in a mixed material is as follows.

3,500 threads ÷ 185,000 yards = .0189, warp weight without take-up.
10% take-up in weaving.
.0189 ÷ .90 = .0210, total weight of warp yarn per yard of cloth.

$$\frac{68 \text{ picks} \times 37'' \text{ reed width} \times 36''}{36''} = 2{,}516 \text{ yds.}$$

of filling per yard of cloth.
2,516 ÷ (40/1 × 840) = .0749, total weight of filling per yard.
.0210 + .0749 = .0959, total weight per yard.
1.0000 ÷ .0959 = 10.43 yards per pound (grey).

COTTON MARQUISETTE

There are quite a number of fabrics which have one name to the consumers and that are known by some other term to the manufacturers. This is largely because one of the parties considers the fabric weave, and the other the trade names. Marquisettes are one of such fabrics, for they are usually designated as plain gauze by the manufacturer. Gauze, considered as a manufacturing term, is the weave which is applied to the cloth, and does not have any reference at all to the material used or the construction of the fabric. In a general way this class of fabric does not have so large a use as many of the ordinary cloths, but at certain times, there is quite a demand with an additional regular sale. A few years ago the demand was quite extensive, and at present, there are more of such cloths being offered, so that an analysis with a short description may be of interest.

These materials are used largely for overdresses and similar purposes, and while their use is likely to make a garment somewhat more expensive, it often does produce more attractive results, although the prevailing styles of garments have much to do with the amount of attractiveness imparted. Probably most of such cloth is made entirely from silk yarn, but there is also quite a quantity manufactured from cotton and silk in combination, while many fabrics are composed entirely of cotton.

MAIN IDEA.

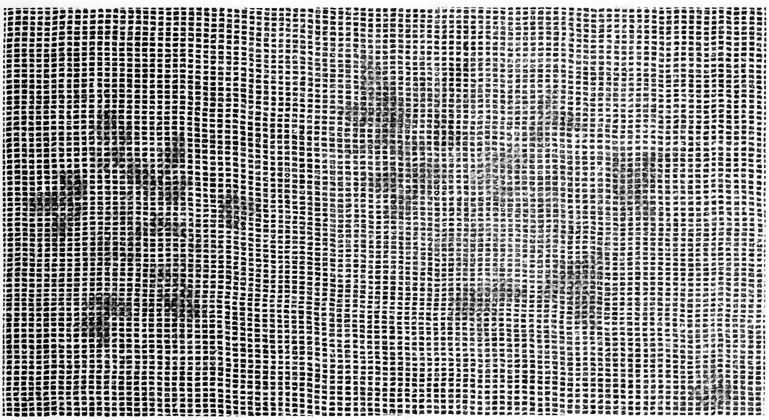
The main idea in constructing a marquisette fabric is to have a very open material, but one in which the threads do not slip to any great extent. Even when the fabric is made wholly of silk there is no great effort made to impart a lustrous finish, because this is not especially desirable nor possible, as the threads twist so much. Because the texture of the cloth is so low and the yarns used are so fine, it is necessary to employ a weave which appears radically different from that noted on all ordinary fabrics. This weave is generally known as gauze by fabric makers, and is the simplest leno weave used.

Naturally, one of these fabrics made entirely from cotton does not compare in effect or sell at as high a price as most of the all-silk or even the mixture fabrics, but, nevertheless, the improvement in finishing methods has made it possible to make cotton fabrics of this character very attractive and much more desirable than they formerly were. Only a short time ago most open-work fabrics woven with a gauze weave were merely dyed solid colors when they were woven, but to-day these cloths contain various printed patterns and colors, and also form the groundwork for additional woven effects, which are sold in quite large quantities and are very attractive. There are other finishing processes employed which give

quite satisfactory results in addition to the printing process. Some of the results obtained are desirable for the reason that they can be obtained in no other manufacturing method, and when in style quite large profits are secured from their manufacture.

The weave used in the ordinary marquisette is called plain gauze, a method by which one thread twists around another, first to one side and then to the other, this thread usually called the ground thread. The thread which twists around the ground thread is usually known as the crossing or douping thread, and is the one the fact that between each pick it crosses to the opposite side of the ground thread. Different methods are used in producing cloth of this character. Probably the method used most extensively is the ordinary leno motion, which we will describe later in a little more detail.

Then there is a method which is often tried wherein a specially constructed reed is used which forces the crossing thread first to one and then to the other side of the ground thread through a lateral motion. Then there are a number of varieties of special heddles which have been



Cotton Marquisette.

which is ordinarily forced into a twisted position by the weave, but in the cloth analyzed, the warp, both ground and crossing, threads are of the same size, and for this reason, the twisted effect produced is noted on both. Inasmuch as the threads twist around each other they bind in the filling much more firmly than in ordinary cloths and prevent any great amount of slipping. The result produced by the twisting of the threads should be clearly seen from the illustration which we have presented. It will be noticed that the ground thread on the cloth considered is never lifted, while the crossing thread is raised at every pick, being held in place by developed for producing leno work and which are used to a certain extent. While these methods all appear somewhat different from the ordinary processes, the results produced are identical, for the principle is the same. In our illustration we have given four picks of the cloth, separated so that they can be easily distinguished, and the weave by which they were produced.

Naturally, a special weave such as that considered has to be made in a different manner than that ordinarily noted. In the first place, it will be seen that two heavy lines have been drawn close together at the bottom of the illustration. The first one of

these lines represents a harness which contains no heddles at all, and which is generally called the doup or slip harness. The second line which we have drawn represents a second harness, which is generally called the standard harness. On this standard harness are placed heddles of various kinds, that is, so far as their make-up is concerned, although they act similarly. On the bottom of the first or doup harness are tied loops of yarn which pass up and through the eye in the second or standard harness, sometimes being held in place by the warp threads when drawn in, but in most cases being held in place by passing through a double heddle eye. The remaining two harnesses are exactly the same as are used in making ordinary cloth. The fifth heavy line which we have drawn does not represent a harness, but is a slackener rod, which is necessary for successful loom operation, because when the threads are in a crossed position there is an undue strain on the yarn which may cause excessive breakage unless relieved. The crossing threads are all held up by this rod and let off when the threads take a crossed position, being pulled up again when the threads are reversed.

The warp is drawn in as follows: All the threads are first drawn in on the two harnesses which are marked "ground" just as if plain weave cloth were to be produced, that is, one thread is drawn on one harness, the next on a following one, and the operation continued until the whole warp has been drawn in. When this has been done, the crossing thread is taken and crossed over or under the ground thread, as the case may be, and then drawn into the loop of the doup which passes through the eye in the second or standard harness. This operation is done for each crossing thread, and when completed the whole warp is drawn through the reed. It should be understood that the crossing and ground threads which operate together must be reeded in the same dent or a crossing will not take place. The slackener rod is usually adjusted after the warp is drawn in and placed in the loom.

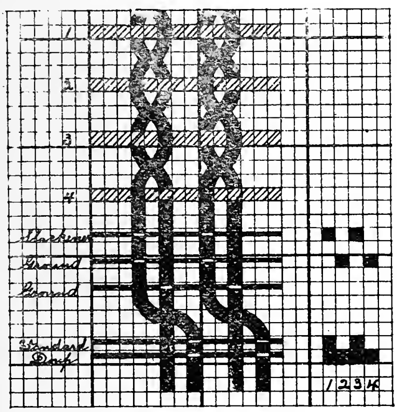
By referring to the illustration the method of drawing in should be very clear, the white spaces showing the harness on which the threads are drawn. One item which is important is that when the standard harness is raised the doup harness must also be raised, because the loops pass through the heddle eyes of this harness, and if it were not done, the doups would soon wear out. Usually, an arrangement is made whereby this is done without considering it in the design, but we have treated each harness separately, so as to make the method more evident. If the standard and doup harness be lifted it will be noted that the crossing thread will be on the right side of the ground thread. This crosses the two threads, so that the slackener must be operated to let off a few inches of yarn and lessen the strain. This is for the pick which is marked No. 1.

On the second pick the ground harness which contains the crossing thread is raised, and, at the same time, the first or doup harness is raised. The lifting of the ground harness causes the doup to slip through the eye of the standard harness and around the ground thread, thus bringing the crossing thread to the opposite side of the ground thread from that noted when pick No. 1 was inserted. The following picks are a repetition of these first two described.

It will be seen that the ground thread harness is never raised, while the crossing thread is actually lifted every pick, but, due to the crossing of the threads, it is bound in tightly. Practical working conditions make it necessary for loom changes to be made so that an open shed dobby will work satisfactorily, but the principle of the weave is no different from that described. We have explained the operation of bottom doups, that is, ones which have the doups tied to the bottom of the slip harness, but there are also leno fabrics made which have top doups on which the doups are tied to the top of the slip harness.

Because of the fact that the cloth is an openwork one and rather light in weight, silk yarns are used extensively in its manufacture. Not only

does this method of production make a light fabric, but it also results in an even or regular product, for the silk yarns have practically no fibres projecting, which condition is likely to fill up somewhat the open spaces in a fabric composed of cotton yarn. To make a regular appearance when cotton yarns are used, it is customary to use fine two-ply yarns, for this results in a smoother product, besides making the yarns stronger and more able to stand the crossing operation, with fewer breakages. Naturally, the use of fine two-ply cotton yarn will increase the cost of making, but the



Weave Plan.

fabrics are usually light in weight, and good results must be obtained even at an increased price.

It is rather hard to ascertain just what the best cloth construction is when any sizes of yarn are considered. This is because a change of a few picks will either produce a good or an unsatisfactory fabric. The crossing or twisting of the threads makes it impossible to place very many picks in the fabric, and for this reason, the correct construction should be left largely to the mill. The right number of picks per inch will cause fewer breakages and seconds and less trouble in manufacturing. The production per loom is quite large, due to the comparatively few picks per inch, and loom speeds are slower than for ordinary cloths, because more time is necessary for the satisfactory changing of the thread, so that excessive wear may not occur on the doup yarn.

FABRIC VARIETY.

While it is true that most of the gauze cloth produced is similar in effect to the cloth analyzed, it is also a fact that this weave is used with dobby and also with fancy jacquard figures. Sometimes the crossing thread will cross over more than a single ground thread and at other times more than a single thread is used for crossing purposes. In fancy weaving, all these threads can be woven plain or in various figures as desired, thus producing a pattern similar to that made on the ordinary jacquard, and with the remainder of the cloth of openwork material similar to that of the fabric considered. Other fabrics are produced wherein the woven figures will be made in jacquard style and woven on a box loom, with the ground of the cloth composed of ordinary gauze. Where the figure is not woven in the extra yarn is sheared off, leaving practically a transparent ground decorated with more or less heavy jacquard figures. Such cloths are used for window curtains, door panels and similar purposes, and have quite a steady distribution.

The principle of weaving is, however, founded on the features which we have explained and should be evident from the illustration which we present. Not only are grey yarns used in these fancy fabrics, but often colored yarn is introduced with good results. The analysis of fabrics which are produced with leno weave is no more complicated than it is for ordinary cloth, the one item which should be especially considered being the take-ups noted on the yarn. Because of the crossing of the threads the take-ups on the yarn are likely to be a greater amount than for ordinary cloths, both for warp and filling, and this feature naturally affects the cloth weights and the cost of production.

It is well to remember that fabrics such as those analyzed have a very large proportion of labor and expense

included and a comparatively small cost, due to material, so that any saving which can be effected through a greater production is usually much larger than can be obtained through cutting down the material. An extra loom per weaver, through the use of a longer or better cotton, is often responsible for a lower cost of making, because the weaving cost is high, and a greater number of looms per weaver more than makes up for the additional cost due to higher-priced stock. Each mill has conditions of operation which are somewhat different and has to determine which course is best for them through experience.

The yarns in any fabric which have to be duplicated usually have to be considered from the finished sample, and some allowance must be made for the losses in finishing. It is very likely that the losses in the yarns used in this cloth are in the vicinity of 10 per cent, due to stretch, loss in bleaching and other items. It is believed by those who have made experiments along this line that allowances for the above conditions have been altogether too low and that finished cloths are lighter than when grey to a greater extent than generally believed. The method of obtaining the weights of the yarn and the yards per pound in a fabric such as that analyzed is as follows:

2,104 threads in ground warp.
272 threads in selvage warp.

2,376 total.

Ground warp take-up 13%.
Selvage warp take-up 5%.
Warp size 100/2.
Filling size 100/2.
Reed width 47¼".
Picks per inch 36.

2,104 ends ÷ (100/2 × 840) = .0501, weight of ground warp without take-up.
13% take-up in weaving.
.0501 ÷ .87 = .0576, total weight of ground warp per yard of cloth.
272 ends ÷ (100/2 × 840) = .0065, weight of selvages without take-up.
5% take-up in weaving.
.0065 ÷ .95 = .0068, total weight of selvage warp per yard of cloth.

$$\frac{36 \text{ picks} \times 47\frac{1}{4}'' \text{ reed width} \times 36''}{36''} = 1{,}701$$

yards of filling per yard of cloth.
1,701 ÷ 100/2 × 840 = .0405, total weight of filling per yard of cloth.
.0576 + .0068 + .0405 = .1049, total weight per yard.
1.0000 ÷ .1049 = 9.53 yards per lb. (grey).

LAPPET DOTTED SWISS

One variety of fabric which has a more or less steady sale, and in quite large quantities, is the cloth usually sold for a cheap dotted swiss. In a general way, such materials are of a light character and made from medium and fine sizes of yarns, either carded or combed, and have a rather sheer effect when finished. They are used for cheap dresses, waists, window-curtains, portiers and similar purposes where there can be large quantities disposed of. Possibly, the majority of such cloths are made with patterns which consist of dots spaced in a diamond position on the cloth. These dots may be either large or small in size and spaced up to about one and one-quarter inches apart in a lateral direction, although special appliances are sometimes used which increase this distance. There are, however, many fabrics made in which there are what are called trailing patterns where the lappet figure is continuous and no shearing operation has to be done, as is noted in the case where separate spots are produced.

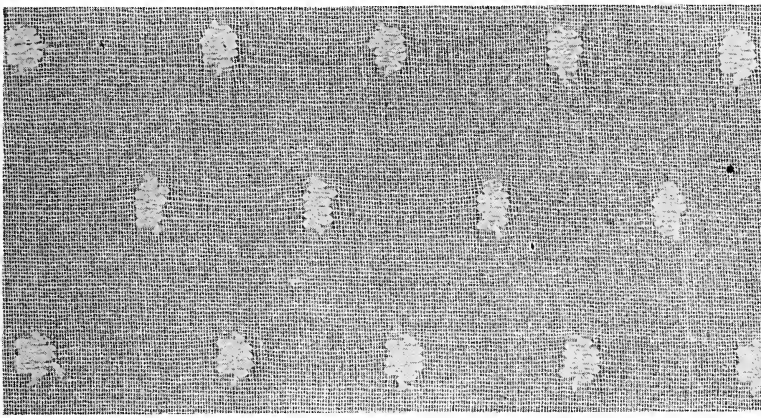
Most of the lappet patterns made are imitations of those made on embroidery and swivel looms, although the results are not so accurate, because the lappet mechanism is not so exact, and for this reason, is usually, although not always, applied to fabrics of lower quality. At certain times, it is also true that lappet figures, both of the spot and trailing variety, are applied to various kinds of medium and even heavy-weight waisting and dress materials, with a resulting improvement in their appearance, and not only are grey cotton yarns used, but there are also colors employed, and in quite a number of cases, both raw and dyed silks. It is also possible to have the loom attachment such that three different patterns can be placed on the cloth simultaneously, so that quite intricate and varied effects can be obtained. The illustration which we use shows two widely different varieties of lappet patterns, one made from grey yarns with a spot effect which has to be sheared before

selling and finishing, and another which contains dyed yarns and is woven with a trailing pattern, and not only is one lappet pattern employed, but it will be noted that two distinct lappet patterns have been used, thus making it necessary for two needle bars to be used on the loom lay, which are operated by two entirely different lappet chains.

The motion or attachment which permits the making of a pattern somewhat similar to embroidery is generally known as a lappet motion. It can be used either on a plain or a dobby loom, and is a system of levers operated by a cam or by a chain composed of different sizes of balls, arranged according to the pattern desired. On the loom lay, and moving back and forth with it, is a slide which is free to move latterly, and which can also be raised and lowered at the correct time. This slide contains a number of needles, the lower portion of which have eyes through which a thread or threads can be drawn. The number of needles on the slide is determined entirely by the pattern which is to be produced. Through a system of levers this slide is operated by a cam or by a chain as explained.

When the slide is held up, no pattern is made, because the threads are above the warp, but when it is lowered at the proper time, or when the shed is open, the filling passes over the yarn in the needle's eyes, thus binding it in the cloth, and then by moving the slide back and forth for the succeeding picks, the various lappet patterns are produced. The needles have to be lifted when the lay beats the filling into the fell of the cloth or else the fabric would be spoiled, and this operation is accomplished by a loom mechanism. The shuttle does not run close to the reed as in ordinary cloth making, but next to a row of pins between which and the reed there is space for the lappet needles when they are depressed to form the pattern. Much of the evenness of a lappet pattern is secured by the tightness of the motion, for any great amount of play will cause unsatisfactory results. The lappet yarn is not placed on a heavy beam at the back of the loom, but is wound on a light spool which is placed near the front over the warp yarn and on the loom frame.

Due to the large take-up in weaving, which will be explained more fully later, these spools contain yarn



An Inexpensive Lappet Made From Grey Yarns and Sheared After Being Woven.

to weave out only a portion of the ground warp. If they were made heavier the operation would not be so successful, so when one spool runs out another is inserted and the various threads drawn in by the weaver, this operation taking but a short time, inasmuch as there are usually only a comparatively few lappet ends. One other feature which has to be considered in producing patterns by this motion is that the movement back and forth of the loom lay causes the lappet yarn to be regularly slack and tight to an excessive amount and some arrangement has to be used so as to take up the slack yarn. Usually this arrangement is very simple, being nothing more than a light wire apparatus over which the lappet yarn passes and is operated by a light spring. Through such a method the yarn slips back and forth through the needle eyes and causes no great trouble.

The variety of cloths to which lappet patterns are applied is so wide that any statements regarding the fabric constructions used would be rather inadequate, but for the simple cloths which contain dots a number of general statements may be made. Usually the main idea in producing a fabric of this character is to get it out as cheaply as possible, and therefore the number of threads and picks per inch are comparatively low. It is also true that a light sheer ground cloth is desired, for this allows the lappet dot or figure to show in contrast with the body of the fabric. To produce this light ground cloth the yarns naturally would be of comparatively fine sizes. Both carded and combed stock is used, depending a good deal on the results desired and on the mill producing the goods.

The lappet yarn is usually of heavy size so as to form a distinct figure in contrast to the ground cloth, and it is also to be noted in the majority of cases that the lappet yarn is two or more ply. This is done because the continuous rubbing of the lappet needles, as the loom lay moves back and forth, would cause many breakages if the yarn was single, while with ply yarn practically no lappet yarn breakage is noted. When cheap results are desired it is customary to use carded yarn for the lappet, in fact, it is usually used because the continuous twisting of the yarn in the pattern eliminates the uneven yarn effects which may be present, and also because a greater or less portion of the yarn is sheared off in spot patterns.

Naturally, when a higher price is being received for the woven material a greater amount of leeway is allowed in the yarns used, and sometimes combed cotton yarn, especially if it is first mercerized, is utilized and oftentimes silk yarn is used both for spot and for trailing patterns. Often silk filling is used for some of the more expensive fabrics, and in these cases the cloth has quite a high count, although still light in weight, due to the use of silk. Recently, there has been a large number of lappet dots applied to fabrics which contain hard twist filling and which are finished as crepes in fact, the ground cloth construction is identical with many of the cheaper or medium priced crepe fabrics. One of the most common lappet constructions used is 72 threads per inch and 48 picks per inch, with 50s warp and 60-1 or 70-1 filling, the yarn sizes varying somewhat, due to mill conditions. The lappet yarn is usually in the vicinity of 30-2 and is of carded stock, while the other yarns are often of combed stock.

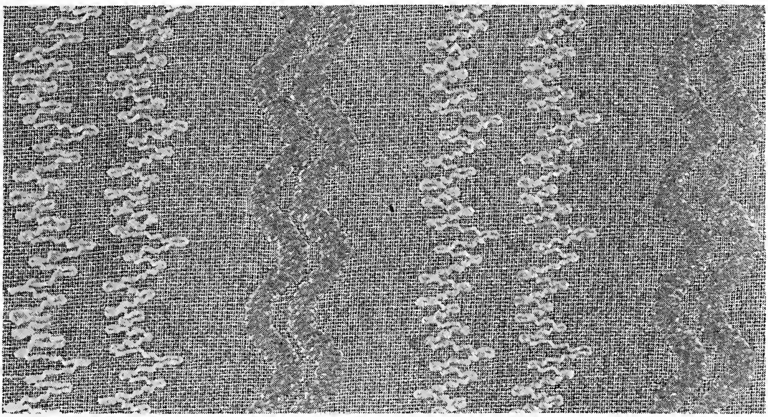
PATTERN MAKING.

There are two general classifications of the various lappet patterns, first, those which consist of a spot effect in different arrangements and in which the lappet end floats over a portion of the cloth and second those which are designated as trailing patterns where the lappet end or ends weave in continuously on practically every pick. When the first class of pattern is being made an extra process is necessary after the cloth is woven, for the lappet yarn, which floats from one spot to the one following, must be cut off so as to leave the ground cloth entirely clear. In shearing these floats off, the loose thread is first cut and then, in a second process, the cut ends are brushed up and clipped off close to the woven spot or figure. In the

majority of cases where the first kind of patterns are being made, it is better to produce the effect through means of a cam, as this results in more accurate mechanical operation. There is, however, a limit to the extent of pattern which can be placed on a cam and usually such methods are confined almost entirely to dots of various sizes.

When the trailing patterns are to be produced a chain of balls is the common method, the diameter of the ball regulating the operation of the lappet needles. If the extreme range of pattern which can be produced is in demand and this is an advantage when some looms are considered. When clipped spots are being produced it is sometimes the case that a process is used whereby the cut ends are pulled through to the back of the cloth, although this is not done when a low-priced material is desired.

Usually a lappet loom will be operated at a somewhat slower speed than plain or dobby looms producing the ground cloth alone, that is, a dobby loom which was operated at about 160 picks per minute would be operated at possibly 145 or 150 picks per minute if a lappet pattern were to be



A Lappet Woven from Dyed Yarns and Containing a Trailing Pattern.

one and one-half inches, and there are 20 sizes of balls employed, the effect desired is divided into 20 parts, and each part will be represented by a certain size of ball. When this has been done it is easy enough to make up the loom chain after making due allowances for the number of picks per inch in the fabrics. Because there is some variation in the mechanical operation of the lappet motion, it is often necessary that the pattern be tried and then adjusted at the loom especially when balls are used to produce the pattern. The use of a lappet motion on a loom does not prevent the making of ordinary plain or dobby fabrics when ordinary lappets are not added to the effect. The looms per weaver are approximately as many as when no lappet pattern is used, that is, if six dobby looms were operated by a weaver on a certain pattern the same number would be likely to be operated if a lappet effect were added. The weaving cost is slightly higher because of the slower loom speed and a somewhat smaller percentage of production. There are, of course, many patterns where the above is not true, when more than one lappet bar is used on a cloth, but for a one-bar lappet the statement applies to the majority of fabrics.

One important feature which has been alluded to before is the take-up

of the lappet yarns. This is of importance because unless care is exercised the cloth weights obtained will not be correct, and the cloth cost resulting will be likely to cause losses. Due to the crossing back and forth of the lappet threads it takes an excessive amount of yarn to weave the cloth, the extra amount depending entirely on the fabric and the cloth construction. Spot patterns are likely to take from three to five times the length of yarn to produce any certain lengths of cloth, while trailing patterns may take from five to fifteen times as much as the length of cloth produced. A cloth with a large number of picks per inch usually has a very high take-up on the lappet yarns. It is a very good plan whenever possible to leave from one-half to three-quarters of an inch of plain cloth next to the selvages when arranging for lappet patterns, as this facilitates the handling of the cloth and makes a better result, and besides causes less trouble in weaving with a smaller percentage of seconds. It is sometimes almost impossible to eliminate streaks in a lappet fabric of light construction, because a heavy lappet yarn has a tendency to hold the picks back and thereby cause thick and thin places in the cloth. Too much tension on the lappet yarn spool will cause the heavy yarn to pull the ground warp ends together, thus creating an uneven finished effect.

The yarns used in making this kind of fabric will vary widely due to the different conditions of manufacture. It is, however, necessary to have the yarns of fairly good quality, because the light character of most of the cloth will show up any irregularities and cause criticism of the finished results. When yarns are to be dyed before the weaving operation they will probably contain a longer staple of cotton for the same size of yarn than those which are to be used in the grey state. The filling when dyed is also likely to contain quite a little more twist per inch than when used in the grey state, because the extra twist makes the yarn stronger and facilitates handling. In a general way the use of dyed yarns will make a fabric cost a greater amount than would otherwise be noted. For the yarns used in the grey fabrics, the yarn layouts would be approximately as follows, although they may vary widely from the figures given, due to manufacturing conditions in the different mills:

50/1 combed warp.
.1667 grs. per yard.
.98 2% contraction in twist.
———
.1634
10 spinning frame draft.
———
1.634 ÷ 2 = .817 = 10.2 hank roving.
6.6 jack frame draft.
———
5.39 ÷ 2 = 2.70 = 3.08 hank roving.
5.5 second intermediate frame draft.
———
14.85 ÷ 2 = 7.43 = 1.12 hank roving.
4.4 first intermediate frame draft.
———
32.69 ÷ 2 = 16.35 = .51 hank roving
3.7 slubber frame draft.
———
60 grains finisher drawing sliver
45 grains card sliver.
12 oz. lap.

65/1 filling combed.
.1282 grains = 1 yard.
.98 2% contraction in twist.
———
.1256
9 spinning frame draft.
———
1.1304 ÷ 2 = .565 = 14.75 hank roving.
6.8 jack frame draft.
———
3.84 ÷ 2 = 1.92 = 4.34 hank roving.
5.8 second intermediate frame draft.
———
11.14 ÷ 2 = 5.57 = 1.49 hank roving.
5 first intermediate frame draft.
———
27.85 ÷ 2 = 13.92 = .60 hank roving.
4.3 slubber frame draft.
———
60 grains finisher drawing sliver.
45 grains card sliver.
12 oz. lap.

30/1 carded warp.
.2778 grains = 1 yard.
.98 2% contraction in twist.
———
.2722
9.5 spinning frame draft.
———
2.58 ÷ 2 = 1.29 = 6.46 hank roving.
6.25 fine frame draft.
———
8.06 ÷ 2 = 4.03 = 2.06 hank roving.
5.25 intermediate frame draft.
———
21.16 ÷ 2 = 10.58 = .79 hank roving.
4.25 slubber frame draft.
———
45 grains finisher drawing sliver.
45 grains card sliver.
12 oz. lap.

The method of finding the weights on grey lappet fabrics is no more difficult than it is for ordinary cloths, if due care be exercised in obtaining the take-ups, especially on the lappet

yarns. On ordinary fabrics of this nature the finishing processes are quite simple, the white cloths being bleached and then starched and folded or, if dyed, they are dyed in a similar manner to an ordinary piece-dyed material, while the fabrics which contain bleached and dyed yarns are usually washed and starched and are then ready for sale. The amount of starch added depends altogether on the fabric, many of the cheap white materials being treated to quite a large amount, so as to keep the threads in place and make the cloth appear better, while many of the better cloths contain comparatively little of such sizing material. The process for obtaining the weights on the dotted fabrics for which the yarn layouts are given is as follows:

Cloth width finished 27".
Cloth width grey 27¼".
Width in reed 29¼".
Threads per inch 72, finished.
Picks per inch 47, finished.
Threads per inch 71, grey.
Picks per inch 48, grey.
Threads in warp 1962.
Lappett ends in warp 27.
Reed (2 in a dent) 33.
Warp size 50/1.
Filling size 65/1.
Lappet size 30/2.
Warp take-up 5%.
Lappet take-up 75%.
Price to converter about 5½c. grey.
Price to consumer usually 12½c. per yard.

1,962 ends ÷ (50/1 × 840) = .0467, ground warp weight without take-up.
5% take-up.
.0467 ÷ .95 = .0492, total ground warp weight per yard of cloth.

$$\frac{48 \text{ picks} \times 29\tfrac{1}{4}'' \text{ reed width} \times 36''}{36''} = 1{,}404$$

yards of filling per yard of cloth.
1,404 ÷ (65/1 × 840) = .0257, total weight of filling per yard of cloth.
27 ends lappet ÷ (30/2 × 840) = .00214, weight without take-up.
75% take-up in weaving.
.00214 ÷ .25 = .0086, total weight per yard of cloth for lappet yarn.
.0492 + .0257 + .0086 = .0835, total weight per yard.
1.0000 ÷ .0835 = 11.98 yards before shearing (grey).

MERCERIZED POPLIN

There is one line of cloths which is being used in increasing quantities and which is certain to have more or less of an influence on future cloth sales. This line of fabrics is the one generally known as mercerized poplin. There are certain styles of materials which sell in large quantities when the market is right for them, but which at other times have a comparatively small sale, and are replaced by other fabrics, and it can be said that the cause of such fluctuating sales is largely because of the whims of fashion.

The fabric which we are to consider was generally thought of, a number of years ago, in the same class as other fancy materials, and sellers expected to see a big decrease in sales which, up to the present time, has not been noted. It is true that the quantity used in the future may not be as large as it has been in the recent past, but it is very unlikely that the sale of mercerized poplins will ever again be of small proportions. This is because consumers in general have realized the great value and beauty of the cloth and the wide variety of uses to which it can be successfully applied. Such fabrics are used for dresses, waists, children's suits and rompers, men's shirts, ladies' belts, raincoats, and, in fact, about any place where attractive appearance and cloth-wearing value is of importance.

A good many sellers have adopted one of the ordinary good poplin constructions and are trade-marking and advertising it, and expect that it will be in the future the most important staple fancy cloth in the market. In addition to the ordinary plain white material which is so often seen, there are similar cloths dyed in solid colors, the same kind of materials decorated with plain and fancy silk stripes in white and various colors, and dobby and jacquard weaves are often applied to the poplin fabrics, so that the variety of effects possible is about as wide as it is on any ordinary fancy cotton mill product.

A NEW CONSTRUCTION.

When a poplin construction is mentioned it is generally well recognized what kind of a cloth is designated, and many would be inclined to view the fabric as being one which has been produced for a good many years but this is not true, inasmuch as the present mercerized fabric bears very

little resemblance to the old style, well-known poplin. This is mainly because the fabric is mercerized before being sold, and as mercerization is a comparatively new process, the methods having been available not much in excess of ten years and used in large quantities a much shorter time than this, it can be said that the present poplin is a rather new cloth.

Inasmuch as the mercerization process is aided by certain yarn constructions, the yarns which are used in the present fabrics are made in a different manner than those formerly used, although the yarn sizes are approximately the same. It is also probably true that the recent large development in fine cloth-making has made the quality of the yarns for the same sizes used in poplin much better than ever before, naturally resulting in a better appearing cloth. In any kind of fabric which is to be mercerized there are a few general manufacturing features to be considered. The more nearly parallel the cotton fibres in the yarn are the better is the result likely to be when finished.

Mercerization makes the cotton fibre, which is a small, flat-twisted tube under ordinary conditions, change into a tiny round fibre very much like a small glass rod when examined under the microscope. As the ordinary spinning process twists the fibres together, the more they are twisted, or the higher the standard of twist is, the less will be the lustre imparted by mercerization because the parallelism of the fibres will have been destroyed through the twisting, while the less twist the yarn contains the greater is the lustre likely to be. It is for this reason that the yarns for use in cloths which are to be mercerized are spun with a low standard of twist.

The reduction of the twist standard naturally results in the production of a weaker yarn, and as the length of the cotton fibre has much to do with the strength of the yarn, it is customary to use a somewhat longer staple of cotton so as to obtain adequate yarn strength.

Mercerization is produced by the action of caustic soda on cotton cloth, but the cloth when being treated must be held tightly or no mercerized effect is produced, thus, if the filling is the portion being treated the cloth is held out wide, while if the warp is being treated the cloth is held tightly in that direction. Single filling can be spun satisfactorily with a low standard of twist, because there are no processes after the yarn is spun, while in practically all cases where the warp is to be mercerized the yarn must be twisted after spinning, because soft twist single warp would be impractical through excessive breakage due to the soft twist, while with two-ply this trouble is largely eliminated.

FABRIC CONSTRUCTION.

A poplin fabric is one wherein there is a greater number of threads than there are picks per inch, usually two or more times as many, and in most cases, the warp is of finer size than the filling. The above method of developing a cloth produces one where there appears to be ribs in the filling direction, the number and size of which are regulated by the picks per inch and the size of the filling yarns, and the excessive number of threads per inch in the warp practically covers up the filling which is used.

Under these conditions most of the fabric wear is noted on the warp yarns, and the fabric will wear as long as the warp yarn is strong enough to hold together. The idea is used in cloths made from various materials, for it is adopted in silk, wool and cotton and not only in the materials as mentioned, but also in mixture fabrics, such as silk and cotton, silk and wool, cotton and linen and also in some cases entirely from linen. Not only are poplins made entirely from cotton, but they are made from different qualities of stock for warp and filling, that is, the warp will be made from combed stock, while the filling will be produced from carded stock, and the warp may be of fine two-ply, while the filling may be of heavier single yarns.

This is entirely possible, because the warp practically covers up the cheaper filling. Many poplins are made of

single yarns, but the largest sellers of recent years and the ones which will have a continuous sale are those made from two-ply yarns, at least so far as the warp yarn is considered. Possibly the fabric which is selling in largest quantity is that which counts about one hundred threads and 48 picks per inch in the grey state, is about 28 inches wide, and contains 60-2 soft twist warp, and from 24-1 to 30-1 filling. There has been a large sale of a carded poplin construction which has a count somewhat similar to that above mentioned and which is made from 30-1 carded warp and 25-1 filling, but which is not mercerized, and which is not so attractive, neither does it sell for as high a price as the fabric which is now considered the standard poplin.

There are also many poplin fabrics made where the count of the yarn is higher than the 60-2 previously mentioned, for 70-2 and 80-2 are often used with a greater number of threads per inch and in many cases with the filling of two-ply yarn and a corresponding increase in the number of picks per inch. As a usual thing the

GROUND WEAVE

of all poplin cloths is plain, the effects being largely stripes, composed of either silk or cotton, and the figures, when produced on a jacquard loom, are not especially attractive because of the small number of picks per inch.

When a few picks are used in any cloth it is almost impossible to produce very good woven effects, because the filling does not cover up well, and when floated will produce a rather ragged appearance. Because a plain weave is used on many of these fabrics, it might be supposed that the automatic loom would be available for the weaving operation, and while this is sometimes the case on many of the cheap lines, the higher quality of most of the fabrics seen makes it necessary that more attention be given to the weaving of the cloth, and besides the saving through the use of the automatic loom is not especially large, because the cost of production is not very high in most cases. The fabric weight will vary, due to the count and the sizes of yarn used, but in most cases the weight of the cloth in the grey state is from 4½ to 5¾ yards per pound for cloth which is 28 inches wide.

SELLING PRICES.

Possibly the new style of poplin illustrates very well the reduction which consumers have been obtaining the past year or so on quite a number of what might be designated as fancy goods. Not only are prices radically lower, but the fabrics are much better at the low prices than they were at the former high prices. Somewhat less than ten years ago poplin cloths for mercerization were developed, and because they were a new thing and manufacturers and finishers were not experienced in their production, the costs of making and finishing were higher, or appeared higher, than they do to-day, although the quantities made were so small that the returns received were not so large.

Competition was also responsible for lower prices, because a larger sale was possible as consumers realized the large cloth value. Prices for finishing have also declined quite a good deal, due to the handling of large amounts, although the lower finishing prices do not indicate that finishing profits have been less desirable than they were. The

GREATER PRODUCTION

at the mill, and the more extended finishing has produced a better and cheaper cloth.

In some cases, when such fabrics were first woven, the operatives ran but a single loom, while to-day the usual method is to operate six, the increase being due to the greater experience of the operatives and the better adaptation of yarns and processes. When first sold these fabrics were retailed at about 50 cents per yard, and in some cases even higher, while to-day the standard retail price is 25 cents per yard, with good profits to all sellers, although in some cases there is even a lower price than 25 cents per yard. The reduction in price has not occurred in a single year, but has been gradual as the various makers and sellers became accus-

tomed to making and handling the fabric. It is, however, likely that the standard price will remain at 25 cents per yard, for there seems to be very few opportunities for any further reduction.

The price for bleaching, mercerizing and finishing the cloth as it is sold to-day varies somewhat, but in a general way is about one and one-half cents per yard. Similar reductions to that noted on poplins have been seen on many of the silk mixed fabrics, and also on other lines of all-cotton fabrics, so that, although a great many more expensive cotton cloths are being produced than ever before, the consumer is obtaining far more value on a good many lines than was previously the case.

MANUFACTURING FACTS.

There is comparatively little shrinkage in width between the woven cloth and the width of the warp in the reed. The high number of warp threads and the heavy size of the filling tend to hold out the cloth when it is weaving and make the above noted small shrinkage. Possibly a shrinkage from reed to cloth of about one-half inch will cover most fabrics of this character. Because of the cloth construction it is necessary to use a fine reed in weaving, thus, for such a cloth as that described, a 50 reed would be used with two ends per dent. If three or more ends were placed in a dent and a coarser reed used the weaving operation would undoubtedly be facilitated, but the reed marks would probably be very noticeable in the finished cloth, and trouble will arise from this fact, so that mills do not care to attempt such a method.

Inasmuch as a fine reed is used, the two-ply yarn will sometimes cause trouble, because the knots will not pass through the reed and will break, causing a loss in loom production. The reed will rub the soft twisted warp yarn if the number of threads per inch be too high or if the yarn size be too coarse for the reed. Good cotton is generally used because of the soft twist in the yarn and to cause less loss of production in weaving. The fabric is piece mercerized, that is, it is treated after it comes from the loom. The mercerizing process can be accomplished either before or after the bleaching process, in most cases being done before the bleaching takes place.

The reason the cloth has so much wearing value is because there is so much material included and such a comparatively small weaving and expense cost, these two items often being less than 20 per cent of the total mill cost, a condition seldom noted on fancy cotton cloths which are produced in large quantities.

MILL PRICES

for the ordinary poplins have varied somewhat, partly through the fluctuation in demand, partly because of the varying prices of cotton, and partly because different mills produce slightly different constructions. The cloth we have analyzed contains 50-2 warp instead of 60-2, as is usually noted, and this added weight makes the cost to manufacturers slightly higher than when 60-2 is used, even though the price for 50-2 is less per pound than for 60-2. The regular poplin construction with 60-2 warp has sold as low as 9¼ cents per yard, and the price of 10½ cents, which we have given, can probably be bettered in a good many cases, at least when 60-2 is used for the warp.

A net profit of one cent per yard to the mill will return a rate of profit of over 15 per cent, and while fancy cloth profits have recently been high, it is not likely that they will continue so on a staple construction such as that considered. The reason why the net profit per loom is so large when such a small profit per yard is secured is because the loom produces a large number of yards per day or per week, due to the comparatively small number of picks per inch.

YARN AND CLOTH WEIGHTS.

The ordinary poplin construction, such as that considered, is a simple fabric construction, and although the threads and picks per inch, together with the yarn sizes, bear no resemblance to the yarn of an ordinary print cloth, this method of obtaining the weight of the yarn and the yards per pound is no more complicated. It

... very true that most of the poplins sold contain very little sizing materials, such as is noted in a good many of the ordinary print cloths when in a finished state, and for this reason the finished weight of the fabric will vary somewhat from print cloths.

In a general way a poplin cloth will be anywhere from five per cent to ten per cent lighter when finished than when woven. The warp, which sizes in the grey state 50-2, will be in the finished cloth size about 55-2, and in this kind of a fabric the loss on the warp will be greater than the loss on the filling. This is due to the soft twist employed and the greater number of processes through which the warp yarn passes, and also to the finishing of the cloth, the filling being used in the loom as it comes from the frame, and being covered up by the warp, so that the loss is not so high as it is on the warp yarn. The method of obtaining the yarn and cloth weights is as follows:

2,874 ends ÷ (50/2 × 840) = .1369, warp weight per yard without take-up.
7% take-up in weaving.
.1369 ÷ .93 = .1472, total weight of warp per yard of woven cloth.

$$\frac{48 \text{ picks} \times 28\tfrac{1}{2}'' \text{ width in reed} \times 36''}{36''} = 1{,}368$$

yards of filling per yard of cloth.
1,368 ÷ (28/1 × 840) = .0582, total weight of filling per yard of cloth.
.1472 + .0582 = .2054, total weight per yard of cloth.
1.0000 ÷ .2054 = 4.87 yards per lb. (grey).

PATTERN.

50/2 Am. combed warp $\frac{2}{12}$ — 2,826 $\frac{2}{12}$ = 2,874, total ends.
28/1 Am. combed filling; 48 picks.
50 reed; 28½" width in reed; 28" grey width; 27" finished width.
102 × 48 grey count; 106 × 47 finished count

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
50/2 Am. combed warp, 1 5-16" staple; 10 hank dou. rov.,	21c.	16½c.	2¾c.	= 40¼c.
28/1 Am. combed filling, 1⅛" staple; 6½ hank dou. rov.,	15c.	8¼c.		= 23¼c.

COST.

2,874 ends 50/2 Am. combed + 7% take-up	= .1472 @ 40¼c. =	$ .0593
48 picks 28/1 Am. combed filling	= .0582 @ 23¼c. =	.0136
Weaving	=	.0074
Expenses	=	.0080
		$ .0883
Selling (grey)		.0018
		$ .0901
Mill selling price (grey)		.1050
Bleaching, mercerizing and finishing		.0150
Cost to converter (not including expenses)		$ .1200
Cost to jobber		.1350
Cost to retailer		.1750
Cost to consumer		.2500

Yards per pound 4.87 (grey).
Yards per pound about 5.30 finished.
Plain weave.

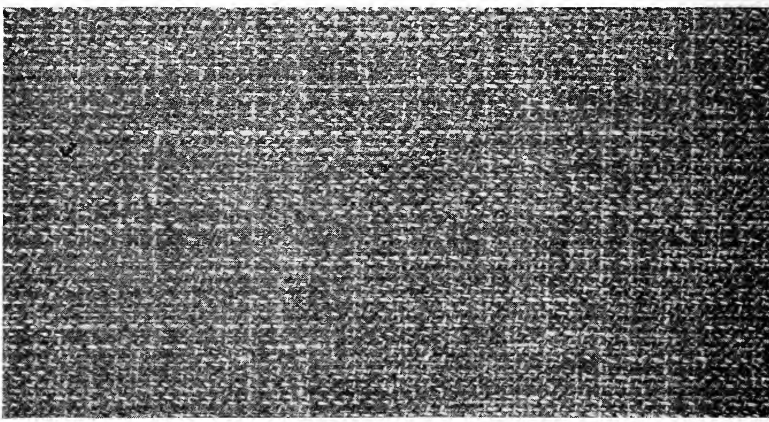
"MOCK-TWIST" SUITING

One line of fabrics which is of interest at present and which shows a variation in method of making from that ordinarily noted is so-called "mock twist." Because of a number of reasons, mixture fabrics have been selling very well in woolen goods, and, naturally, it would be expected that similar effects would be in demand when produced from cotton. Usually, when made from cotton, cloth prices are comparatively low, and yarns are not made of especially good stock or very fine sizes, possibly in the majority of cases being between 10s-1 and 20s-1 for both warp and filling. These materials are used for dresses and other similar purposes where a rather heavy colored fabric can be used.

With the exception of the color effect, the cloth is not unlike many of the piece-dyed cotton fabrics which are now being sold in some cases as linens. The width of the fabric will vary somewhat, for they are sold at 27 and 32 inches wide, although possibly the largest portion is being sold at the wider width. Most of the cloths are made with a plain weave, although in a few cases, some of the more simple weaves, such as twills, baskets and sateens are used. For the above reason, these cloths can be made on automatic looms with advantage, and probably many of them are produced in this manner. The irregularity of the cloth effect, due to the mixture yarns, makes the standard of quality somewhat lower than it otherwise would be, and allows the most ordinary mills to produce them if their equipment is such that they can dye the cotton in the raw state before the yarn is spun.

In a general way, the yarn as it stands in the cloth appears much the same as if it were two colored yarns twisted, and because it is not regular two-ply yarn it is called "mock twist," so as to distinguish it. A mill to be able to produce yarn of this character must have an equipment which permits the dyeing of raw cotton, and is ordinarily known as stock dyeing. Inasmuch as most of the colors used are dark shades it is seldom that the cotton fibre is bleached before dyeing.

When the raw cotton has been dyed it is handled in the same manner as ordinary raw cotton, and is drawn and spun into roving of the size desired, for the yarn in the fabric considered the roving being approximately 2.50 hank. The white cotton which forms the contrast with the darker color is given what is often called a half bleach before it is handled, that is, it is given a processing which eliminates a great portion of the cotton color and makes it seem white when twisted with the dyed stock. The white cotton is made into the same size of roving as the colored cotton, and after being bleached is handled in exactly the same method. Up to the spinning frame the two kinds of cotton are kept separate, and care must be exercised not to have colored waste or cotton fly become mixed with the white stock.



"Mock-Twist" Suiting.

Usually, when stock-dyed cotton is being handled a certain number of cards and following machines are kept running on one color continually, thus making the problem somewhat more simple and keeping the various colors

from becoming mixed. One fact which is noted is that when stock dyeing is used the fabrics produced are almost always staple ones, and the range of colors is limited, often being as few as a half dozen, and not changing from season to season as on other lines. Stock dyeing is used not only for mixed fabrics such as that analyzed, but also for many lines of ordinary ginghams, drills, twills, and, in fact, most kinds of ordinary staple fabrics, and, in addition, is utilized in making a certain class of novelty yarns which have a more or less steady use. When the dyed and bleached rovings are completed at the fly frame they are placed on the spinning frame, one end of color and one end of white stock being placed together. The operation of this frame is no different than in ordinary cases, and the rovings are drawn out, this process keeping the colors practically separate. The insertion of the twist by the spindle twists these two elongated roving ends together, and inasmuch as the colors are contrasting ones, the effect produced is not unlike a two-ply yarn made with two colors.

It is, however, apparent on examination that this "mock-twist" is not so regular as ordinary two-ply yarn, for the irregularity of the single yarns allows the twist to run into the fine portion of the thread, resulting in an uneven twisted effect. Of course, this running down of twist would be less prominent in a better yarn, but for the fabric considered, and for general fabrics of this nature the irregularity of twist does not make much difference. The above result is also seen in ply colored yarns to a certain extent, but it is not nearly so prominent as in the stock-dyed material. There are certain advantages to be gained by making some fabrics by the "mock-twist" method. In the first place, it results in a fabric being made from single yarns instead of ply yarns, thus enabling the mill to produce a lighter material and one which has a different appearance than a ply yarn fabric.

For another reason, it allows more twist to be introduced without making a harsh cloth than if ply yarns were placed in the fabric, thus giving a better mottled effect. It also makes it possible for a mill which does not contain twisting frames to produce two-ply effects, and, naturally, does not upset the organization of the plant, for it allows the yarn sizes to be made for which the machinery is best adapted.

Possibly, the largest item of interest is the fact that the making of "mock-twist" yarn results in a colored two-ply effect, but at a very much lower cost than it could otherwise be obtained. This statement is made even after due consideration has been given to the better effect produced by the use of ply yarns in a fabric. One reason why the cost is lower is because the charge for dyeing raw cotton is less than it is for dyeing yarns, and the process eliminates many expensive after-processes which are noted when yarn is dyed. With stock-dyed cotton the processes used in producing cloth are practically the same as for grey cloth, that is, the yarn is spun and the warp is spooled, warped and slashed, while the filling is ready for the loom when it comes from the spinning frame.

With bleached and dyed yarns the method is usually more extensive and costly, for after the yarn has been spun it is spooled, warped and then doubled, making it easier to handle, dyed, sized and then separated and beamed. Afterward, it is put together in any warp pattern desired. The filling is treated in much the same manner as warp, except that it is not beamed but is quilled instead. The above method applies to yarns which are not to be twisted. When colored twisted yarns are to be produced, the grey spun yarn is often made into skeins and then dyed, after which it is spooled and twisted. After the twisting operation, the warp is spooled, warped and slashed in a method similar to that used on any other ply yarn, while the filling is spooled, ball-warped and quilled. Often methods are changed somewhat so as to be more economical for the individual mill, but in all cases the cost of making colored two-ply yarns is very much higher than for making the "mock-twist" yarn which is used in the

fabric considered. Without doubt, the use of stock-dyed yarns will increase quite a little, and will ultimately form the bulk of the materials used in the production of colored staple fabrics on which the cloth construction and colors change but little, and where profits are made through economical mill methods rather than through the fabric style.

It will readily be recognized that the effect in the cloth considered is made almost entirely by the novelty yarn which has been used, and for this reason, the cloth as it comes from the loom is practically ready for sale. Before shipment, however, it is washed and sized, so that it presents a somewhat better appearance. The amount of size or starch placed in this variety of cloth will vary according to selling conditions and the ideas of various buyers, but usually it contains a rather small amount, so that it is not too stiff. Instead of being folded and sold in the way most colored cloths are, this material is often sold in the roll form. One fact which is particularly noticeable on this sort of material is that the reed marks are quite prominent, especially when the fabric is held up to the light, and they detract a great deal from the cloth appearance. This condition is almost always apparent in fabrics which are practically ready for sale as they come from the loom, but is seldom noticed on cloths which have to be bleached, dyed or finished after the weaving operation. For this reason, the last named fabrics usually have a more regular finished appearance and are more desirable in some cases.

There has been at certain times a line of printed fabrics produced which are very similar to the woven material which we have analyzed. The ground cloth used in such cases is a grey cloth of just about the same construction as the one which has been analyzed and which is first bleached and then printed with an irregular or allover pattern which closely resembles the woven effect noted in this cloth. Naturally, because of manufacturing facts, there is not so wide a difference between the cost of the printed and dyed material as in most fabrics of such character, and for this reason, buyers are apt to prefer the stock-dyed cloth.

Because of the appearance of the fabric it would not be expected that it would be sold at any exceptionally high retail price, or compete in any way with the high-class novelty cloths now offered, but it does offer quite an attractive appearance, and it can be sold so as to allow a fair margin of profit to the various sellers and also to the mills which manufacture it. One of these cloths is selling at 9¼ cents per yard by the mill selling house to the jobber. This makes it possible for the latter to sell at about 10½ cents a yard to the retailer, who can offer the cloth to the consumer at 15 cents a yard.. Other similar fabrics are being sold at prices which place them in the 19-cent retail class, but it is probable that few are selling at any higher figures. Inasmuch as this cloth weighs about 3⅞ yards per pound, the mill selling price with cloth at 9¼ cents a yard, is about 36 cents a pound, a good price when the production costs are compared with ordinary grey cloths. An analysis of the fabric shows the following details:

Cloth width finished, 32".
Warp count finished, 40".
Filling count finished, 34".
Threads in warp 2/8—1 262—2/8 = 1,294 total ends.
Warp size 12/1 "mock twist."
Filling size 12/1 "mock twist."
Width in the reed, 35½".
Reed, 18 (2 ends per dent.)
Warp take-up, 7%.
Warp weight per yard, .1380
Filling weight per yard, .1197
Yards per pound, 3.88
Plain weave.

The standard of twist in the filling in many of these cloths is about the same as it is for the warp yarn used. This makes a stronger filling, which, of course, is not at all necessary, but it also makes the filling effect the same as that of the warp yarn, often a more important feature in some materials, although it is not always noted and not entirely necessary. During the last year or so all kinds of special yarn effects have been in demand for the making of cloths, not only when colors are used but also when irregular effects such as those

used in eponge are considered, and it is very likely that the making of special cloths or constructions has compelled manufacturers to realize that there are unlimited possibilities in the making of cloth, which, up to the present have hardly been attempted, but which will receive a great deal more attention in the future. The obtaining of experience is bound to show in the quality or variety of fabrics produced in domestic mills, in fact, it is already noticeable in the greater variety and more attractive appearance of the fabrics now offered, and in the profits which are being secured in their making.

It has already been noted that the quality of the yarn used in a good many fabrics similar to that analyzed is not especially high, and is, therefore, made in a manner to result in a low cost of production. A good many coarse yarns of the sizes used in the cloth are made from single roving on a spinning frame, but this method is impossible for the yarn considered, for it is necessary to have double roving on the spinning frame, so as to obtain the twisted effect. When single roving is used, it is possible to make yarn of the sizes considered with two processes of fly frames, but when double roving is used on the spinning frame it would be necessary to have three processes of fly frames, so as to obtain practical manufacturing conditions. One layout for 12s-1 warp, which may give a general idea as to the draft and sizes at the various frames, is as follows:

12/1 carded "mock twist" warp.
1 yd. = .6944 grs.
.0098 2% contraction in twist.

.6805
9½ spinning frame draft.

6.46 ÷ 2 = 3.23 = 2.58 hank roving.
5 fine frame draft.

16.15 ÷ 2 = 8.08 = 1.03 hank roving.
4¼ intermediate frame draft.

34.34 ÷ 2 = 17.17 = .48 hank roving.
3¾ slubber frame draft.

65 grains finisher drawing sliver.
65 grains card sliver.
95 card draft.
14 oz. lap.

The method of obtaining the weights of the yarn per yard of cloth is exactly the same as for any ordinary grey or colored fabric. When the material contains any size or filling, it should be eliminated by washing or boiling, but care should be exercised in obtaining the take-ups before the boiling out process, as the fabric may shrink quite a little when treated in a small piece. One fact which is often of importance is that stock-dyed yarns are not likely to be lighter in the cloth than they are when they come from the spinning room, a condition which is often noted, sometimes to an excessive degree, on yarns which are dyed after they are spun and handled in a number of processes. Dyed yarns have never been considered light enough when compared with the sizes of the yarn as they come from the spinning frame. The process for the fabric considered is as follows:

1,294 ends ÷ (12/1 × 840) = .1283, weight of warp yarn per yard without take-up.
7% take-up in weaving.
.1283 ÷ .93 = .1380, total weight of warp yarn per yard of woven cloth.

$$\frac{34 \text{ picks} \times 35\tfrac{1}{2}'' \text{ width in reed} \times 36''}{36''}$$
= 1,207 yards of filling per yard of cloth.
1,207 ÷ (12/1 × 840) = .1197, total weight of filling per yard of cloth.
.1380 + .1197 = .2577, total weight per yard.
1.0000 ÷ .2577 = 3.88 yards per lb.

PRINTED SILKALINE

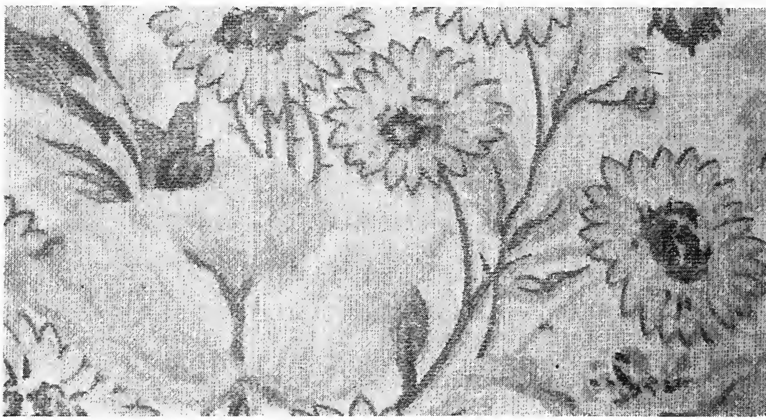
There is one line of fabrics which has a more or less regular sale, and which, for a number of reasons, is of much interest. This is the fabric which is known as silkaline, although it must be admitted that the count and yarns used in producing it will vary to quite an extent. In a general way the material is of a light character, usually weighing more than eight yards per pound in 36-inch cloth and in the majority of cases probably between 10 and 11 yards per pound in the grey state. The effects produced on the cloth are made entirely by the finishing process and consist largely of floral patterns, often in quite a number of colors.

Styles of figures and the colors used will change somewhat, but the distribution of these lines offers op-

portunities which are not noted in many of the higher priced fabrics for building up an output and a reputation. Silkalines are used for a wide variety of coverings, and recently printed cloth coverings have been applied to articles never before treated in such a manner, thus giving a largely increased sale. They are used for curtains, a certain range of styles for drapery purposes, portieres, and, in fact, for any use where a light fabric is suitable, but one which has desirable decorations and can be purchased at a relatively low price. There is much which might be said regarding the producing of the patterns which are used on this style of cloth, but they are largely ornamental ones, and their beauty depends upon the adaptability and also upon the blending of the colors to produce the desired effect.

Sometimes the use of one color which does not harmonize with the others may render undesirable an otherwise beautiful result, so a good many features must be considered in this style of cloth which are seldom thought of when woven effects are being made.

The foundation cloth which is used in the production of silkaline is most always made with plain weaves. This is necessary, because the number of threads and picks per inch are comparatively few, and when plain weave is used the greatest amount of cloth firmness is obtained. Plain weave is also used, because any woven effect is not very prominent when fine or comparatively fine yarns are used in making the cloth, and would be a waste of effort, because it would increase the cost of making with very little advance in style, and in addition the printing operation is very likely to cover up and render valueless any patterns which may be woven. Inasmuch as plain weave is used almost entirely, this cloth can be made successfully on an automatic loom, although, for various reasons, some mills have never adopted them.



Printed Silkaline.

Of course, there is not so much saving through the use of automatic looms on fine as there is on coarse cloth, but with competition as keen as it is to-day, every new appliance which brings about economy must be used or profits are likely to be small and irregular. The reason fine cloth is not made as successfully as coarse on an automatic loom is because fine warp is not so strong as coarse and will break more easily, thus causing a loss of production. Fine cloth usually contains a large number of threads per inch, thus increasing the number of stops per loom. Automatic loom warps must be made strong, so

as to have few breakages if the greatest advantage is to be obtained from the automatic filling or shuttle-changing attachment.

Practically all the fabrics which are used in the production of silkalines are made from grey yarns, a fact which results in the lowest possible cost of production. Fabrics are produced both from carded and from combed yarns, the price varying according to the kind of yarns used, the cloth construction purchased and the demand noted at any particular time. One construction, which is used extensively is 72 x 60, containing 50-1 warp and 80-1 filling, and weighing about ten yards per pound in the grey state. The price for a combed cloth of this character is likely to be somewhere in the vicinity of 5 to 5¼ cents per yard, while that of a carded one is likely to be about 4½ cents per yard, although sales have been made at various times at much below these figures.

The fabric which we have analyzed is somewhat similar to the one previously mentioned, inasmuch as the warp contains the same number of threads per inch and the yarns are very similar, although the picks per inch are slightly less.

The details regarding this cloth are as follows:

Width of cloth finished 36 inches.
Width of cloth grey 36 inches.
Width of warp in the reed 38 inches.
Threads per inch finished 72.
Threads per inch grey 72.
Picks per inch finished 52.
Picks per inch grey 51.
Threads in warp 2/10 2,564 2/10 = 2,604. total ends.
Reed 34 (2 ends per dent).
Warp size 50/1 carded.
Filling size 75/1 carded.
Warp take-up 4%.
Warp weight .0646 per yard.
Filling weight .0314 per yard.
Yards per pound 10.42 grey.

Inasmuch as the grey cloth is more or less of a staple fabric, there is a good deal of competition among the mills which produce it and profits are regulated somewhat by the economy which is practiced in the manufacturing processes. The yarns used are about as fine as can be produced satisfactorily from carded stock, and the labor cost will vary to a much greater extent than in the coarser lines. Not only will the labor costs vary, but the stock used will also differ, partly because of the machinery available and partly because of the quality of the fabric desired.

The warp is usually of coarser size than the filling, for such a method allows it to be handled more satisfactorily, while the filling is ready for use when the spinning operation is completed and can be made into finer yarn from the same length of cotton staple. This same condition is noted on a large proportion of ordinary print cloths, for although warp and filling are made of the same cotton, the size of the warp is less than that of the filling, being 30-1 for warp and 38-1 for filling. Probably both warp and filling for this cloth would be produced from cotton, which is about one and one-quarter inches in length, although the staple used for a plain fabric is somewhat shorter than for one which has any special features.

A general idea regarding the mill layout for making these yarns may be obtained from the following schedule:

```
50/1  carded warp.
.1667 grains per yard.
  .98 2% contraction in twist.
-----
.1634
   10 spinning frame draft.
-----
1.634 ÷ 2 = .817 = 10.2 hank roving.
  6.6 jack frame draft.
-----
 5.39 ÷ 2 = 2.70 = 3.08 hank roving.
  5.5 second intermediate frame draft.
-----
14.85 ÷ 2 = 7.43 = 1.12 hank roving.
  4.4 first intermediate frame draft.
-----
32.69 ÷ 2 = 16.35 = .51 hank roving.
  3.7 slubber frame draft.
-----
   60 grains finisher drawing sliver.
   45 grains card sliver.
   12 oz. lap.

75/1  carded filling.
.1111 grains per yard.
  .98 2% contraction in twist.
-----
.1089
    9 spinning frame draft.
-----
.9801 ÷ 2 = .49 = 17 hank roving.
  6.9 jack frame draft.
-----
 3.38 ÷ 2 = 1.69 = 4.93 hank roving.
  5.9 second intermediate frame draft.
-----
 9.97 ÷ 2 = 4.99 = 1.67 hank roving.
  5.3 first intermediate frame draft.
-----
26.44 ÷ 2 = 13.22 = .63 hank roving.
  4.5 slubber frame draft.
-----
   60 grains finisher drawing sliver
   45 grains card sliver.
   12 oz. lap.
```

Naturally on any carded yarns as fine as those used there must be as

MUCH CARE EXERCISED

in mixing the cotton bales and in having the machinery in good operating condition as there would be if combed yarn were to be produced. The use of a cotton which is too short or excessive drafts on any frame will probably handicap the weave room seriously and make the percentage of production in that department decline radically, and will ultimately affect the cost of production more than if a reasonable policy had been adopted in the yarn making.

Some manufacturers prefer to use but two processes of pickers when yarn of this character is being made, mainly because the longer staple cotton is not so dirty and a smaller amount of beating is likely to preserve the fibre length better. As evenness is largely responsible for yarn strength the number of doublings is increased over that of the yarns used in many ordinary cloths, for there are three processes of drawing, and practically always four processes of fly frames.

Single roving is never used on the spinning frame, as yarn made in this manner would not be sufficiently strong. When automatic looms are in use it is a good policy to use a somewhat better quality of cotton as this method will increase the weaving production, although there is a certain point where the higher cost of cotton will more than offset the added loom production. The card production is decreased so that it is not over three-quarters as much as when making many ordinary carded yarns, oftentimes the production being about 85 to 90 pounds per day.

FINISHING.

The fabric as received by the finishing works is in what is called the grey state; that is, the cloth is practically the same as the cotton when received at the mill, except that it is a different state, being cloth instead of raw cotton. Fabrics such as that considered are not generally finished by the mill which produces them, but by a party usually called a converter, who obtains a price from the various finishers for accomplishing the work, and who afterwards sells the goods. Some finishers also act in the same capacity as a converter, for they purchase the grey cloth from mills and finish it as they themselves desire, and then sell to the jobber in a method very similar to that of the converter.

Naturally, on some lines the finisher, when he acts as a converter, has a certain advantage over the ordinary converter, although on other lines this is not so evident. The cloth is first boiled off and bleached so that the size, cotton wax and other impurities present will be removed. When the cloth is in the white state or practically similar to many low count lawns or like fabrics, it is subjected to a further process which consists of running through a printing machine, which machine places upon the fabric the colored pattern which is desired.

Each different figured pattern produced has to have a separate set of rolls. These rolls are composed of copper and the pattern is engraved on them, the sunken portion containing the color, and, by contact, the cloth as it passes over the roll takes up the color. Instead of the dyestuff being in a liquid state, as in the ordinary dyeing operation, it is thickened with various gums and starches and made up into a paste form so that when taken up by the copper roll it will remain in the engraved portion. Excess color paste is removed from the roll before it comes in contact with the cloth by a finely ground knife edge. Each color on the cloth is represented by a separate roll in the machine; that is, for a pattern with five colors employed there would be five rolls used, each roll being engraved for the portion of the pattern where its color is used, with a sufficient al-

lowance for the spread of the color paste when it is taken up by the fabric.

After the printing process the colors which are placed upon the cloth are set so as to make them satisfactory for wear, the method of setting depending on the colors used. As a last process, before folding, packing and shipping, the cloth is subjected to a heavy calendering process, which imparts to the cloth the glazed surface which reflects the light and makes the fabric have a silk-like lustre. Of course, this glazed surface and lustre is not permanent, but it serves to make the fabric surface smoother and very much less likely to soil.

PRICES.

As stated previously, there is quite a little competition on these fabrics, not only among the grey cloth makes, but also among the parties who distribute them in the finished state. The 72x60 ten-yard combed regular grey goods have been sold at a comparatively recent date for 4½ cents per yard, although the quoted price is somewhat higher. The price for finishing will vary in the different plants and also according to the kind of pattern and number of colors used. For an ordinary printed fabric similar to that analyzed, and which contains no special features, the entire finishing price is about one and one-quarter cents per yard for patterns in which two colors are used, one and one-half cents per yard for patterns in which four colors are used, one and three-quarters cents per yard for patterns in which six colors are used, and two cents per yard for practically all other styles. Some finishers add one-eighth of a cent per yard for each additional color, beginning at one and one-quarter cents for two-color work.

On this basis the cost of finishing the cloth considered would be one and three-quarters cents per yard. It often is the case that an overall price is made to cover the selection made for the entire order, which is, perhaps, a more satisfactory method for many cloths, inasmuch as the converter usually sells the whole color line at a regular set price, making no difference in price in regard to the number of colors used in the pattern. The jobber's purchase price is usually about seven and one-half cents per yard, and in some cases the fabric is sold to the retailer at from eight and one-half cents to eigh and three-quarters cents per yard.

The retail price in a good many instances is 12 or 12½ cents per yard, and in some cases 15 cents per yard is asked, this mainly because material is sold in the upholstery department, where the cost of selling is rather high and where excessive profits are sometimes made. There is very little reason why fabrics such as that analyzed should carry any higher profits than the ordinary dress goods, for the distribution is just about as large as for dress goods, and the actual costs of selling no higher, but in most cases the profit is somewhat higher, the extra gain being obtained by the retailer alone and not by the jobber or converter.

An examination of the cost as given will make the prices and ranges of profits of the various sellers clearer. An analysis of a fabric such as that considered is not at all difficult. It should be remembered that the yarn is finer when the cloth is sold than when the yarn was spun. The warp is likely to be from 5 per cent to ten per cent finer, depending on the amount of size in the finished cloth, while the filling is not likely to lose quite so much weight as the warp, due to less handling and stretching of the cloth in making and finishing. The method of obtaining the yarn and cloth weights for the fabric considered is as follows:

2,604 ends ÷ (50/1 × 840) = .0620, weight of warp per yard without take-up.
4% take-up in weaving.
.0620 ÷ .96 = .0646 total weight of warp per yard of woven cloth.

$$\frac{52 \text{ picks} \times 38'' \text{ width in reed} \times 36''}{36''} = 1{,}976$$

yards of filling per yard of cloth.
1,976 ÷ (75/1 × 840) = .0314, weight o filling per yard of cloth.
.0646 + .0314 = .0960, total weight per yard
1.0000 ÷ .0960 = 10.42 yards per lb. (grey)

PATTERN.

50/1 Am. carded warp $\frac{2}{10}$ 2,564 $\frac{2}{10}$ = 2,604, total ends.
75/1 Am. carded filling, 52 picks.
34 reed, 38" width in reed, 36" grey width, 36" finished width.
72 × 52 grey count; 72 × 51 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
50/1 Am. carded warp; 1¼" staple; 10 hank dou. rov.,	19c.	11¾c.	=	30¾c.
75/1 Am. carded filling; 1¼" staple	19c.	15½c.	=	34½c.

COST.

2,604 ends 50/1 Am. carded warp + 4% take-up = .0646 @ 30¾c. =	$ .0199
52 picks 75/1 Am. carded filling = .0314 @ 34½c. =	.0108
Weaving =	.0036
Expenses =	.0046
	$ .0389
Selling (grey)	.0008
	$ .0397
Price to buyer (about)	.0425
Cost of bleaching, printing, etc	.0175
Cost to converter (not including expenses)	$ .0600
Cost to jobber (about)	.0750
Cost to retailer (about)	.0875
Cost to consumer	.1250

Yards per pound 10.42 (grey).
Plain weave.

CREPE WEAVE FABRIC

It is generally well known in the cotton goods trade that crepe fabrics have been in very good demand, and that quite large quantities are being sold at present, and, in addition, that there will be a more or less general sale of such materials in succeeding seasons, although, of course, the amount sold will depend a good deal upon the varying conditions of the market. Most of such crepe fabrics are produced through the use of hard-twisted yarn, usually the filling, and being woven in a few instances on an ordinary loom, and in the large majority of cases produced on a box loom, especially those fabrics which are considered high class and which are sold for high prices. Of course, crepe fabrics in which hard-twisted yarn has been used do sometimes have woven figures placed upon them, but because of the method of production the cloth weave is practically always plain or at least very simple, the cloth effect being developed entirely by the yarns.

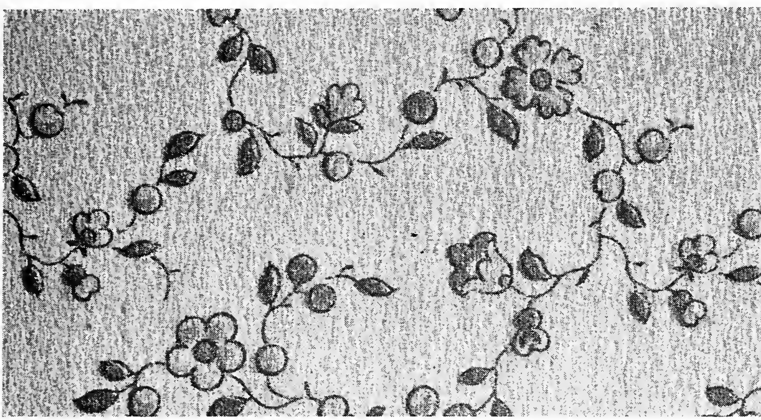
The use of hard-twisted yarn is, however, not the only method by which a crepe effect can be obtained, for they are sometimes made through the fabric weave and with regular yarns, that is, yarns in which no extra twist has been inserted. Naturally, a fabric which is made with a crepe weave does not appear very similar to a fabric made with crepe yarn, but the irregularity is present in both styles, and for general use it is probably true that the crepe weave gives a better result on medium or heavy weight fabrics, while the crepe yarn is unquestionably better on the lighter materials; in fact, a crepe weave is of little value in many fine cloths, inasmuch as woven figures do not show up well when fine yarns are used. Both kinds of crepe fabrics are used for dresses, waists and similar purposes, and are finished in the various popular colors. A feature worth mentioning is that the printed styles of the same fabric are being used for trimming purposes on the solid colors, and because the styles of printed patterns contain colors which are in demand to-day they are having quite a distribution for the above purpose.

As previously stated, yarns used in the fabrics considered are no different than in many ordinary cloths. A por-

tion of the cloth was originally made of two-ply yarn, and subsequently the filling was changed to single yarn with the warp remaining of two-ply, and later the entire cloth has been made from single yarns.

The two-ply cloths appear to be made of combed stock, but at least some of the single yarn fabrics are made from carded yarns or from yarns which are no better than many mills can and do produce from carded stock. The reason why two-ply yarns are used is because the fabric is piece mercerized and because they allow a softer twist to be used with a better lustre when finished in much the same manner as is noted in the ordinary two-ply warp and single filling mercerized poplin which is having such a large sale at present. A comparison of the two-ply fabric with the single-ply cloth shows that the change has not been of advantage if appearance be considered. Of course, if the crepe effect is the desirable feature of the cloth, and if a good volume of sales can be made in the single yarn material, then it is naturally a good policy to sell the single yarn cloth, for it can be purchased at a lower price, and therefore allows a wider margin of profit at the same selling price.

The yarn used in the cloth is 40s-2 in the ply-yarn material, while 20s-1 is used in the single yarn fabrics. The count is about 84 by 53 in the finished cloth, the exact amount varying somewhat through the yarns used and the method of finishing. The yards per pound in the grey cloth are about 4.25. The more nearly parallel cotton fibres are in yarn or cloth the more lustrous the material is likely to be when it is finished by mercerization, and one reason why a crepe weave will not be so silky in appearance as a soiesette construction even though the yarns be of equal quality in both fabrics is the irregular nature of the weave in one cloth and the regular appearance in the other.



One of the Crepe Weave Fabrics.

The kind of weave which is employed in this fabric is often used for many styles of shirting fabrics, and is also used extensively in certain kinds of dress materials. If there is no great objection to a certain amount of regularity in weave it is customary to produce the effect on a dobby loom, and where a fabric contains stripes of any nature this method is found very satisfactory, for the stripes partially eliminate the weave defects. Then it is sometimes the practice to combine a number of simple weaves in an irregular manner, thus making an irregular weave, and, in addition, to use

an irregular drawing-in draft on the warp. This method partially eliminates the difficulties, but there are likely to be so-called patterns even when such a weave is made, and these are rather undesirable in a fabric such as that considered, and, in addition, the making of a crepe pattern with an irregular drawing-in draft on a dobby loom is likely to cause much trouble at the mill, and is avoided by the manufacturer whenever possible. For the above reason, many woven crepe effects are produced on a jacquard loom, and this has been done in the present weave.

The effect produced on a jacquard loom, through the great number of harnesses and the width of the pattern, tends to eliminate the irregularities of weave so that there are no long floats in the warp or in the filling. A crepe weave, to be very desirable, must be made with comparatively short floats and still contain very little plain weave in order to produce the irregularity which is desired. It is claimed that this fabric was developed in one of the mills of the Southern states, and because of the wide distribution which the fabric has had, at least four or five other mills, some in the North and others in the South, have been producing it. Without doubt, the fact that not all fancy mills contain twisting spindles may account for a portion of the cloth being made from single instead of two-ply yarn.

Sometimes the production of large amounts of two-ply cloth tends to upset a mill organization, and for this reason, it is sometimes impossible to obtain two-ply fabrics in the quantities desired, especially when two-ply cloths are being sold in quantities. Jacquard patterns have been very good sellers on other fabrics, and mills containing jacquard looms have been pretty well supplied with orders, thus making it necessary to place contracts with different mills in order to obtain the total amount of cloth necessary.

PRICES AND PROFITS.

The grey cloths used in the production of the finished materials are now being sold at about 9¼ cents a yard by the mills, and as these single yarn fabrics are being finished and sold along with the two-ply article, and at the same price, a few statements regarding the profits being secured may be of interest.

For the single yarn fabric it will be noted from our analysis of cost that the net mill cost in the grey state is about 8¼ cents a yard, and as the mill selling price is about 9¼ cents a yard, the profit to the mill is about 1 cent a yard. With a reasonable loom production the net profit per year to the mill would be about $102 per loom. This amount will return a profit of about 10 to 12 per cent, depending on the mill organization, which is not an exorbitant profit, when the facts of distribution and profits being secured on grey cloths of the heavier grades are considered. Thus it will be seen that the mill is not obtaining any exorbitant profits, and the cloth is being purchased by the converter at a reasonable price.

PRICE FOR BLEACHING

The price for bleaching, mercerizing and dyeing, including the casing, etc., is not over 1½ cents per yard. Where the cloth is printed in addition, the price is about 2½ cents per yard. This makes the plain materials cost the converter about 10¾ cents per yard, without including his various selling charges. These are not likely to be much over 10 per cent of the cost of the goods, but, allowing about 12 per cent or 1¼ cents per yard, the total cost to the converter would be approximately 12 cents a yard. Without doubt, these goods (not printed) and composed of single yarns are costing the converter somewhat less than this amount. The selling price to the retailer is about 17 cents a yard, because the goods are sold direct. Thus it will be seen that the net profit per yard on the plain styles is at least 5 cents a yard.

The printed fabrics are, many of them, two-ply materials, so, allowing the grey cloth price of 10 cents a yard, which approximately covers the difference in mill cost between single and two-ply, and at which undoubtedly this material could be purchased, the

cost to the converter for the printed fabric is about 12½ cents a yard, not including his expenses. Adding 12 per cent or 1½ cents per yard for expenses, the total cost for this style would be about 14 cents a yard.

THE SELLING PRICE

to the retailer is about 22½ cents a yard, or a profit to the converter of about 8½ cents a yard for the printed styles. Inasmuch as the distribution of the ordinary plain cloth is wider than for the printed styles, it is likely that the net profit will average 6½ cents a yard for this cloth. The distribution of the material is quite large, the fact that there are a number of mills producing it proving this statement, so there is little doubt but that a total sale of 25,000 pieces or even more will be noted. This quantity is approximately 1,375,000 yards, and at a net profit per yard of 6½ cents, the total profit to the converter would be practically $90,000. This appears like a very large return, but it must be remembered that the converter's position in the distribution of goods allows for a good deal of chance, that is, there are likely to be other fabrics on which a loss is sustained and other fabrics on which a rather small profit is secured, so that the good sellers carry along the other fabrics and make a normal profit possible.

SEASON'S INCREASE.

There are certain seasons when expenses are increased, because the demand declines, and there are other years when the reverse is true, although the 12 per cent expense item which we have allowed should be entirely sufficient for the whole charges of a normal season. The development of a desirable material at the time when it can be sold requires a good deal of ability, and the converter is the party who is carrying such responsibility. No doubt there would have been no great production of high-class domestic merchandise unless the converter had educated other buyers and ultimately consumers into its use, and under such selling conditions, it is only fair that this party should receive a rather high return upon his transactions. Then it is also true that the profit is large in the present instance, because the goods are sold direct from the converter to the retailer. This method of selling eliminates the jobber, and while it increases somewhat the converter's cost of doing business, it permits of a wider margin of profit than is noted when the jobber handles the goods. The converter to-day is in a position of advantage, and has been responsible for forcing a good many domestic manufacturers to be progressive. Otherwise, most of them would soon be settled upon one or another kind of staple fabric from which they either could not or would not depart. This is of advantage to the industry, as it tends to keep up a varied domestic production and increases the taste of consumers in the matter of fabrics and keeps the industry in a progressive condition.

We have already mentioned some of the features in regard to the finishing of the cloth which is being considered. In the first place, it illustrates well the fact that not only the best materials which are made of combed yarn but also many grades of carded work are improved very much through the mercerization process when it can be done at the prices which are noted to-day. We do not state that some of this style, or even all of it, is not combed work, but if it is such there is similar weight carded work which is even better by comparison, so that the single yarn cloths anyway may be considered on a carded yarn basis, at least so far as the result of the finishing processes are concerned. The cloth is piece-mercerized, and this can be accomplished either before or after the bleaching operation.

Possibly in the majority of instances it is done before the bleaching takes place. The cloth is also piece-dyed, and, naturally, solid colors are used because the cloth is made entirely from cotton and no cross dyeing processes are possible. Prices have been quoted for this sort of work as low as 1¼ cents a yard, but we have in our description allowed 1½ cents a yard as being a more reasonable figure and on the safe side, so far as production is considered.

Where printed patterns are employed the fabric ground is left in a white state, and the lustre, imparted by the mercerization process, makes a decided contrast with the printed figure. The colors used in the printed patterns are those which are desirable at present, being of brighter shades than those used other years. One of the features which helps to set off the figure is the outline in black which makes a clear separation between the ground of the fabric and the printed figure.

Prices for printing vary somewhat, and in a good many cases are regulated for the entire order, a price being quoted which applies to all fabrics, and which is a satisfactory method, inasmuch as the materials are sold at the same price to jobber or retailer regardless of the number of colors employed. Where each style has a separate quoted price, there is usually an advance of about an eighth of a cent a yard for each additional color in the printed pattern up to the point where seven or eight colors are used, and usually when the cloth is of such a highly decorative nature, special features or cloth constructions are likely to affect the costs, so that no definite prices can be named.

The obtaining of the yarn weights and after these the total weight per yard of the fabric is a rather simple procedure. A certain number of inches of yarn are pulled out of the cloth, measured and then weighed on an accurate balance, and from this the size of the warp and filling can be obtained through the use of the standard number for cotton, that is, No. 1 contains 840 yards per pound, No. 2 twice this number and No. 50 would, therefore, contain 42,000 yards per pound. The pound basis, when yarn weight is considered, is 7,000 grains per pound. This separation is needed, because when small quantities of yarn are weighed on delicate balances the weight necessarily is small if accurate results are to be obtained.

The take-up of the warp can be obtained when the threads are being pulled out of the cloth, and the take-up on the filling can also be obtained in the same way, and by means of a simple ratio the reed width can be determined approximately when the finished cloth width is known. For practical purposes the exact cloth weight can be ascertained by analysis, because the fabric as produced by the mill will vary as much as 5 per cent in some cases, due to the difference in size of yarns and other producing conditions. The method of obtaining the yarn and cloth weights is as follows:

2,228 ends ÷ (40/2 × 840) = .1326, warp weight per yard without take-up.
4% take-up in weaving.
.1326 ÷ .96 = .1381, total warp weight per yard of woven cloth.

$$\frac{56 \text{ picks} \times 29'' \text{ reed width} \times 36''}{36''} = 1{,}624 \text{ yds.}$$

of filling yarn per yard of cloth.
1,624 × (20/1 × 840) = .0966, total weight of filling per yard of cloth.
.1381 + .0966 = .2347, total weight per yd.
1.0000 ÷ .2347 = 4.26 yards per lb. (grey).

PATTERN.

Ply yarn warp fabric.

$$40/2 \text{ Am. combed warp } \frac{2}{12} \quad 2{,}180 \quad \frac{2}{12} = 2{,}228, \text{ total ends.}$$

20/1 Am. combed filling; 56 picks.
38 reed, 29" width in reed, 27-27½" grey width, 26¼-26¾" finished width.
82 × 56 grey count. 84 × 53 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting		
40/2 Am. combed warp; 1⅛" staple; 8 hank dou. rov.,	15c.	11⅞c.	2c.	=	28⅞c.
20/1 Am. combed filling; 1⅛" staple; 4¾ hank dou. rov.,	15c.	7⅛c.		=	22⅛c.

COST.

2,228 ends 40/2 Am. combed warp + 4% take-up = .1381 @ 28⅞c.	=	$ .0399
56 picks 20/1 Am. combed filling = .0966 @ 22⅛c.	=	.0272
Weaving	=	.0095
Expenses	=	.0129
		$ .0895
Selling (grey)		.0018
Net mill cost (grey)		$ .0913

PATTERN.

Single yarn fabric.

20/1 Am. combed warp $\frac{2}{12}$ 2,180 $\frac{2}{12}$ = 2,228, total ends.

20/1 Am. combed filling; 56 picks.
38 reed, 29" width in reed, 27-27½" grey width, 26¼-26¾" finished width.
82 × 56 grey count, 84 × 53 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
20/1 Am. combed warp; 1⅛" staple, 4 hank dou. rov.,	15c.	7⅝c.	=	22⅝c.
20/1 Am. combed filling; 1⅛" staple; 4¾ hank dou. rov.,	15c.	7⅛c.	=	22⅛c.

COST.

2.228 ends 20/1 Am. combed warp + 4% take-up = .1381 @ 22⅝c.	=	$ .0313
56 picks 20/1 Am. combed filling = .0966 @ 22⅛c.	=	.0272
Weaving	=	.0095
Expenses	=	.0129
		$ .0809
Selling (grey)		.0016
Net mill cost (grey)		$ .0825
Mill selling price to converter (about)		.0925
Cost of finishing (bleaching, mercerizing, dyeing)		.0150
Cost of finishing (printed styles)		.0250
Price to retailer (solid colors) about		.1700
Price to retailer (printed styles) about		.2250
Price to consumer (solid colors)		.2500
Price to consumer (printed styles)		.3500

Yards per pound 4.26 (grey).
Woven on a jacquard loom.

COTTON BENGALINE

There is one cloth which is being used largely at present in various forms and which, therefore, is of quite a little interest to buyers and sellers. It is true that so far as the yarns and cloth constructions used in producing such cloths are concerned the fabrics are very similar to the ordinary poplin, but, due to the method of weaving, a wholly different appearance results. In a general way a bengaline is a heavy corded fabric with the cords running in the filling direction, but recently many very similar fabrics have been produced with the cords appearing in the direction of the warp. Of course, when warp cords are noted the cloth construction is somewhat different than when filling cords are being produced, and many times they are used for the same purposes. Inasmuch as most of these cloths are noted with filling cords, we will confine our short description to fabrics of that character. That there is a wide range of these materials can readily be noted by examining offerings of large retailers who handle novelty fabrics.

Not only are these cloths made entirely from cotton, but they are also made from silk and from combinations of various materials, mainly from silk and cotton. In addition to being made of different materials, they are also produced in

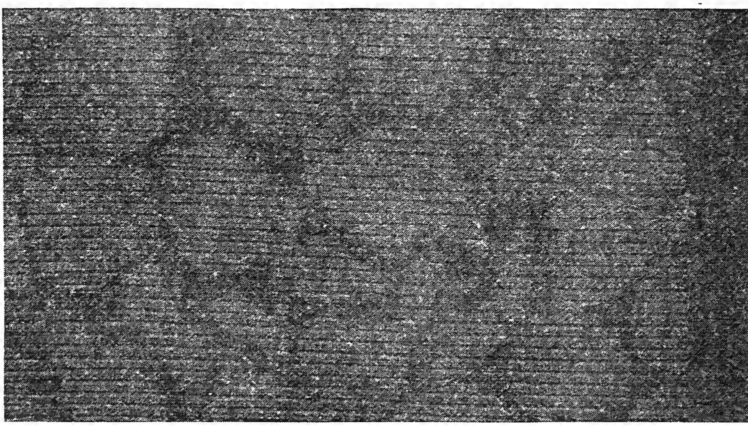
DIFFERENT METHODS,

that is, from grey cotton yarn either single or two ply or both and then piece dyed and mercerized, and they are also made from dyed yarn. Raw silk is also used in many of the fabrics, and such materials are dyed solid colors in a similar manner to that when grey cotton yarns are used, and one of the large productions at present is obtained from dyed silk yarns which through the method of weaving produce changeable color effects.

The combination materials are often dyed solid colors and in other instances are cross dyed, a process which sometimes results in rather novel effects being produced. Bengaline fabrics are used for various purposes, possibly the largest use being for dress materials, both cheap and expensive grades, but they are often

printed in colors and are used for draperies, hangings and similar purposes. Some of the warp cords are used extensively for men's shirting materials, for the making in this manner allows a somewhat wider variety of pattern.

These same materials are also used for ladies' waistings and for children's dresses. Certain expensive bengaline fabrics are also used largely for trimming purposes, both in solid colors and in a printed and enbossed state. It may be a fact that some years the sale of certain styles is rather small when they are compared with staple



Special Silk Bengaline Having a Changeable Color Effect.

lines, but the variety of constructions is quite extensive, thus giving a large total sale.

CLOTH CONSTRUCTION.

Inasmuch as bengalines are somewhat similar to poplins, it is generally true that the warp is of finer yarn and has a higher count than the filling. In a good many cases the number of picks per inch is not over one-half the number of threads per inch. This method of constructing a fabric allows the warp yarn to cover up to a large extent the filling, and often makes it possible to lose a lower grade of filling than might otherwise be the case.

In a good many fabrics which consumers purchase as all silk, there is a cotton filling used; but the silk warp covers up the cotton filling and allows the cloth to be produced at a much lower price, because the filling often forms quite a portion of the cloth weight. It is seldom that the warp threads per inch are less than 100 in cotton fabrics and often in silk materials there are two or three times as many or even more. Naturally, because there is a preponderance of warp threads in these cloths, the wear is practically all sustained by this yarn, and as warp is made of longer cotton and with a higher standard of twist than filling, the cloth can be considered as giving exceptional wear. This is especially true of the bengalines made of cotton yarn with a two-ply warp, for they are just about as serviceable as the ordinary poplins, and these are now becoming recognized as offering one of the best values of any woven fabric.

A good many cotton bengalines are now made with soft twist two-ply warp, a fact which increases the cost of making but which allows the cloth to be piece mercerized, thus increasing very much its attractiveness and making the policy worth while. Without doubt, mercerization will be employed much

more extensively on some of the single yarn bengalines in the future, for it is being ascertained that the results fully warrant the added expense.

FABRIC WEAVE.

Because they are so similar to ordinary poplins, the general cloth construction features of bengalines are easily understood, but the method of producing the corded effects is not so well known, especially outside of manufacturing circles. Some of the effects are made on ordinary plain looms, while others are made on box looms which can weave two picks of any size or color of yarn, and still others, especially when a large amount of silk is used, are produced on a pick and pick loom where a single pick of any size or color of yarn can be woven. The weave would ordinarily be designated as plain. That is, there are usually only two harnesses necessary, and the warp threads are drawn in in regular order, the cord being formed by the harnesses remaining stationary while a number of picks are being placed in the same shade. Sometimes the take-up pawl is lifted when the cord is being formed, thus placing in the cloth more picks than the loom pick gear would indicate, while at other times the pawl is not lifted, the natural tendency of the weave forcing the picks into a cord when the harnesses remain stationary. The above policy is adopted where an ordinary loom is used and where only one size of filling yarn can be woven.

Dobby looms are most always used in making bengalines of this character because orders are comparatively small and cams are expensive and often do not hold picks enough to make them practical, and the use of a dobby allows the filling thread to be caught and held out in a satisfactory manner when the cord is being formed. Box looms are used when different sizes or colors of filling are being used, and in a good many cases produce a rounder cord and a somewhat greater yardage even at a slower loom speed. When picks are forced into the shade to produce a round cord with only a single size of filling used it is likely to cause an excessive strain on the warp yarn and result in a great deal of trouble in the weaving operation. We are illustrating the weave on one of the ordinary fabrics which contains but one size of filling.

It will be noted that we have made

TWO REPEATS OF THE WEAVE

in the filling direction, this being necessary because two picks are placed on a chain bar in a good many instances. We are also illustrating a special silk fabric which has a changeable color effect. This weave is identical with the ordinary three harness twill, but because of the different yarn sizes which are employed in the filling and the different colors which are used in the warp an entirely different effect is produced, and no one from a superficial examination of the cloth would consider that the weave was similar to that of many simple twill fabrics. In the first cloth the cord is produced by placing a number of picks of the same filling in one shade, while in the other fabric the cord is produced by inserting a very much heavier pick of filling.

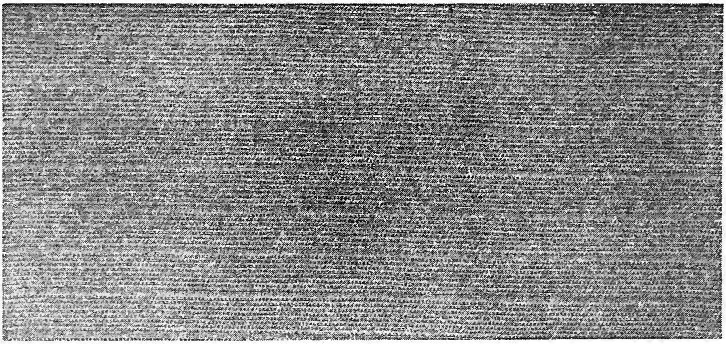
Due to the stiffness of the cords the ordinary bengaline cloth does not shrink very much in the weaving operation, often only one-half to one inch from reed to cloth, and certain special fabrics have an even smaller shrinkage than the amount named. As a general thing the cloth weave is very simple, the cords being at various spacings up to about three-eighths of an inch apart, and sometimes of different sizes, the fancy effects being almost entirely the result of yarn and color combinations, and in some cases of both. Because the weaves which are used are very simple, in many cases being just about the same as that of a plain sheeting, it might be supposed that automatic looms would be used in the production of some of the all-cotton fabrics, but this is not done, mainly because the losses due to seconds increase as the cloth value is higher, and also because the weaving cost is a much smaller proportion of the total cost than on some of the cheaper lines where they can be successfully used. Fewer automatic

looms per weaver would be necessary, and this would naturally cut down the possible savings so that they are not used. Most bengalines would be considered heavy fabrics, even the ones made entirely of silk being of quite good weight because of the cords used.

FINISHING RESULTS.

A good many of the all-cotton cloths are mercerized to-day in addition to the processes which were formerly employed, and because of the use of this process, the yarns composing the fabric are of somewhat different construction than they previously were. ton to anywhere near as great an extent as it did the longer staples, but the variation in result has been found to be from manufacturing conditions more than from the chemical process employed. Long cotton yarns can be twisted very much less than short ones, and still have them practical for a mill, and the less twist a yarn has the more nearly parallel the fibres are, and the greater the lustre obtained when the cloth is mercerized.

Some fabrics have been made in large quantities with filling spun on a ring frame with a standard of twist below $2\frac{1}{4}$ times the square root of the yarn size, but it was done with a



The Fabric Analyzed.

The warp yarn in such cloths is often of two-ply, and contains a comparatively small amount of twist, for this produces better results when finished. It is also true that Egyptian cotton is used to quite an extent in yarns or cloths which are to be mercerized, but this is not so true as it previously was, for the yarns in woven cloth have been found to be satisfactory when made of American cotton.

If all the fabrics which are sold to-day, and which contain mercerized yarn or are piece mercerized, contained Egyptian cotton, there would be a very much greater amount imported than there is at present. It used to be considered that the mercerization process did not affect the short cot- long staple cotton, and price competition has made such a policy rather impossible at present, due to the extra price for cotton. Sometimes bengaline fabrics are printed with

VARIOUS PATTERNS

which make them very attractive, the colors and styles of figures varying with the season. Many of the good mercerized materials which are made from fine cotton yarns approach very closely the effects which can be obtained from similar silk fabrics. Because of such facts, many of the silk bengalines are made to-day in changeable effects. One cloth contains a warp of three colors, one thread of black, one thread of green and one

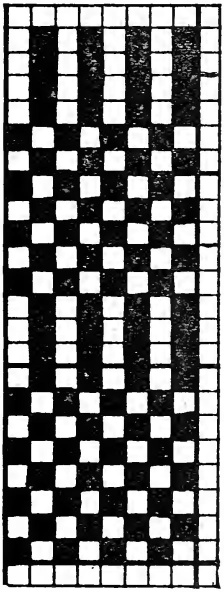
thread of blue regularly throughout the whole warp. Because of the cloth construction, the black yarn weaves in such a manner that it appears only on the back of the fabric, while the green and blue threads alternating on the face create a changeable appearance.

The filling consists of two picks of silk yarn and one pick of heavy cotton, which heavy pick produces the corded effect. Both kinds of filling are dyed a red color, a fact which makes a red and black changeable effect on the back of the cloth. Inasmuch as the large amount of warp (two-thirds of the total amount) is on the face, it covers up the filling entirely. In addition to the color effect, many of these silk or part silk cloths are treated to an embossing process, which method presses a figure upon the fabric very similar in appearance to a jacquard woven effect. Because the cloths have such heavy cords, the results of embossing are much more prominent and last much longer than they do on many other kinds of fabrics, in fact, a woven effect could not be used to produce the kinds of figures which the embossing process does.

These embossed fabrics are practically never washed, so that the method gives satisfactory results. Changeable effects are not always similar to that described, for they often have a bar effect rather than an all-over one. Without doubt, the increased demand for high priced and different materials has resulted in the production of many rather new effects or the variation of old ones in an attractive manner. It is not always necessary to have a fancy weave or complicated machinery in order to produce attractive cloth results, a fact which has recently been recognized by some of the manufacturers who produce even the lowest quality of goods, but who, through ability and slight changes in their fabrics, have been able to obtain higher prices with no great advance in their costs. One of the greatest lessons the American manufacturer is learning to-day is the power of adaptability, and this will show results in more attractive materials in the future, if he is not forced into competition too keenly by the present methods of selling.

LOSSES IN FINISHING.

Possibly, one of the facts which has never been investigated at all regarding cloths is the loss and in some cases the gain which they have in the finishing processes. This does not mean the features which result from the addition of starch or various fillings, but the actual facts concerning the yarns and cloth construction. It has generally been considered that a dyed piece of cloth will weigh just about the same amount per yard as the grey cloth when it comes from the loom, but this is absolutely incorrect in the majority of



The Weave.

cases, even with the addition of sizing material, for, in most cases, accurate experiments will prove that the cloth is somewhat lighter.

There has been no great necessity for experiments being made along these lines, in fact, there are very few

opportunities for accurate investigations of these conditions. The cloth we have analyzed has been treated very carefully, and the warp, which was approximately 60s-2 when used at the mill, in the finished cloth is 66s-2, while the filling, which was approximately 35s-1 in the grey, in the finished state is about 37s.5-1. In this case the warp yarn loses about the same amount as the filling, but other fabric constructions may show entirely different results. The fabric contained 54 picks per inch when it was in the grey state, but, due to the stretch in finishing, it contains only 52 picks when sold. Not only does the yarn size change when the cloth is finished, but it is likely to be somewhat different when various parties handle it. The stretch in finishing oftentimes has something to do with the lighter size of the warp, although this is not always the case.

Results on fabrics which are made with dyed yarns are much easier to obtain, because the processes are usually accomplished in a single plant, and the cloth can be followed carefully. In the analysis of fabrics which are woven of grey yarn and then finished, a great deal of care must be exercised in determining the yarn sizes which are to be used in weaving the cloth, and to base all estimates on the finished yarn in cloth is not a correct policy, and is one reason why the duplicating of cloth is not always the success which some buyers anticipate. When the grey yarn sizes have been correctly estimated, and the threads and picks per inch in the grey cloth obtained, the cloth and yarn weights can be readily found and a fabric can easily be duplicated.

In a bengaline cloth the warp take-up is usually greater than for a good many ordinary materials in which the same or similar yarn sizes are used. The method of obtaining the weights of the yarn and the weight of the grey cloth is as follows:

2,920 ends ÷ (60/2 × 840) = .1159, warp weight per yard without take-up.
9% take-up in weaving.
.1159 ÷ .91 = .1274, total weight of warp yarn per yard of woven cloth.

$$\frac{54 \text{ picks} \times 28\tfrac{3}{4}'' \text{ width in reed} \times 36''}{36''} = 1{,}552.5$$

yards of filling per yard of cloth.
1,552.5 ÷ (35/1 × 840) = .0528, total weight of filling per yard of woven cloth.
.1274 + .0528 = .1802, total weight per yard.
1.0000 ÷ .1802 = 5.55 yards per lb. (grey).

Cotton Bengaline.

PATTERN.

60/2 Am. combed warp $\frac{2}{24}$ 2,824 $\frac{2}{24}$ = 2,920, total ends.
35/1 Am. combed filling; 54 picks.
50 reed, 28¾" width in reed, 28" grey width, 27" finished width.
104 × 54 grey count; 107 × 52 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
60/2 Am. combed warp; 1⅜" staple; 12 hank dou. rov.,	23c.	19⅞c.	3½c.	= 46⅜c.
35/1 Am. combed filling; 1⅛" staple; 8 hank dou. rov.,	15c.	9⅜c.		= 24⅜c.

COST.

2,920 ends 60/2 Am. combed warp + 9% take-up	= .1274 @ 46⅜c. =	$ .0591
54 picks 35/1 Am. combed filling	= .0528 @ 24⅜c. =	.0129
Weaving		.0079
Expenses		.0096
		$ .0895
Selling (grey)		.0018
		$ .0912
Mill selling price (about)		.1025
Bleaching, finishing, dyeing, mercerizing		.0150
Converter's expenses		.0100
Total cost to converter (about)		$ .1275
Price to jobber (about)		.1400
Price to retailer (about)		.1750
Price to consumer		.2500

Yards per pound 5.55 (grey).

MIXTURE MOIRÉ

There is developing in the domestic market a very much larger demand for all kinds of pressed figures than has been noted for some years and of these lines moiré is one of the leading styles. A good many of the pressed patterns now selling have been developed because of the demand for large woven figures, not only in silk but also in cotton and wool, and without doubt these large woven figures cannot be satisfactorily produced on a good many of the cloths now in demand, so that the pressing or embossing method offers opportunities in producing large effects not otherwise obtainable.

It is claimed that the demand has recently been so good for certain of these lines that stocks have been practically cleaned up and that new merchandise is not readily obtainable, especially in desirable weights. The various results are obtained almost entirely from different finishing processes which are given th goods after they are woven, the prices varying according to the methods necessary, the quantity of cloth to be handled, and the demand for merchandise.

A CERTAIN CLASS

of pressed fabrics is continually sold in greater or less amounts and is used for different kinds of linings, book bindings, women's hats, portiers and similar purposes, although, of course, the large sale develops when such pressed materials can be used for dresses, trimmings and coatings. The process is applied to fabrics of different weights and constructions, but it is probable that the best and most permanent results are secured on what might be called the heavier lines.

Fabrics which are to be pressed are often made entirely from silk, although mixture materials are also sold extensively, as this allows the cloths to be produced at a lower price and the effects obtained are just about as satisfactory as if all silk had been used, while for certain uses fabrics made entirely from cotton are of advantage. Due to the character of most woolen yarns, there are very few attempts to press patterns upon cloth woven from this material. It is sometimes done, but the results are not often used for dress purposes, as the pressing makes the cloth, when composed of wool, rather impenetrable to air, which is of importance in dress materials.

CLOTH CONSTRUCTION.

A good many of the fabrics which are now selling are woven with a silk warp and a cotton filling, thus making them very similar to many of the other mixture cloths sold in large quantities and more or less regularly This sort of cloth could be made in fancy cotton mills successfully, though it is probable that comparatively few of them are, due to the large number of threads per inch. In a general way the cloth construction often is the same as for many silk and cotton poplins, with a large number of threads per inch of silk yarn and a comparatively small number of picks per inch of cotton yarn.

The weave is plain in a good many cases, as this produces a firm cloth and allows a good foundation for the finishing effect, and does not break up the effect which is desired to be produced when the cloth is pressed. One feature is that the filling or cotton yarn is often a twisted one. Through this method, the yarn size is likely to be more regular and fewer cotton fibres are likely to project, thus making a smoother fabric when woven. Not only does the ply yarn produce a fabric more similar to an entire silk one, but it is of advantage in obtaining the kind of effect desired, and a more lasting one than if single yarn had been used. The large number of silk warp threads are likely to cover up to a large extent the cotton yarn filling, and because of the difference in the yarn sizes between warp and filling a corded cloth is produced with the ribs running in the filling direction.

The loom production is quite large when compared with many other styles of rather expensive cloth, mainly because there are so few picks per

inch. It might be supposed that some of these mixture cloths would be produced on automatic looms, but this is not true, inasmuch as the weaving cost is so small a portion of the total expense and inasmuch as care must be exercised in the weaving operations. It is, however, true that some of the all-cotton fabrics are produced in this manner, for they are only ordinary plain cloths, and there is quite a little advantage obtained through the use of automatic machinery. Because the production is rather large per loom the cost of production is rather reasonable when the weaving operation is considered. The shrinkage of the warp from reed width to woven cloth is rather small and the same is true when the fabric is finished. The ply filling yarns, partly through the cloth construction used, appear in the cloth much the same as if they were small steel rods and all the interweaving is noted on the warp yarn.

Naturally the number of picks which any fabric of the kind described can contain is limited by the yarn size or diameter. With the exception of the small space taken up by the fine silk warp as it crosses from the face to the back of the fabric, the whole space is taken up by the filling yarns which lie close together in horizontal lines. The number of picks must be nearly as many as the cloth will hold else the finished results will not be as good as they should be when the cloth is pressed.

METHODS EMPLOYED.

There are a number of methods employed by which pressed figures are obtained on cloth. One method, and possibly the one used most extensively and which is illustrated well by the analyzed fabric, is to apply heavy pressure to the cloth with a smooth roll. The material is first folded lengthwise or else two separate widths of cloth are used, one on top of the other, and while they are in a damp state heavy pressure is applied together with heat. As will be readily noted, where the fabric has been folded the pick of one half of the cloth or of another piece of cloth slips into the space between the picks of the opposing fabric, but, due to unevenness in the material, this does not occur throughout the entire cloth width. The great pressure used gives the smoothness which imparts the cloth lustre, for it makes the grooves between the picks more regular, while the watered effect is produced at the points where the picks of one fabric slip over the picks of the opposing fabric and into another groove, thereby flattening out the pick over which it crosses when the pressure is applied.

A second method is somewhat

SIMILAR TO THE ONE MENTIONED,

for the cloth is rolled up and the pressure applied to it in a rolled up state. There is another method which is used extensively in certain lines when an engraved roller is used on which fine lines are cut, and while the cloth is being treated there is a lateral motion which causes a variation in the lines pressed into the cloth. Possibly the method by which the widest variety of patterns is produced, but which is rather expensive, is where a separate roll is engraved for each pattern and on which the cloth construction may be entirely different from what it is in the cloth analyzed.

This embossing process is practically the same in results as the process which is used on paper in so many forms. It is however the case that many cloths have cotton filling yarn because this allows a lower cost of production and aids somewhat in obtaining good results when the cloth is finished. The engraved roller, when one is used, and a corresponding roller, when one is not used, is heated by some method so that the damp cloth is dried and pressed at the same time, a fact which produces more pronounced effects and causes them to be of a more permanent nature. In other words, the pressed effect is ironed into the cloth, forcing the threads and picks into the patterns desired and making them desirable for many purposes. It must not be supposed that moiré effects are the only ones which can be produced by a pressing process because there is a wide variety of styles possible.

Many kinds of cotton lining fabrics have milled surfaces, a method which increases their lustre and desirability and prevents them from getting soiled so quickly. Then there are cloths produced which contain pressed effects, of slash lines, checks, mottled effects, cords and similar styles and in addition there are the many embossed cloths which are used for decorative purposes and which contain about as wide a range of styles as the woven brocade cloths which are sold in quite large quantities. In these materials, ribs and other woven cloth effects are produced which have no direct relation to the picks per inch in the fabric, or the fabric weave, but which are so carefully done that they often deceive the most careful observers and are not noted until the cloth is pulled to pieces in order to obtain the construction used.

In a general way the cloths on which there is to be placed a pressed figure are woven from raw materials, that is, from grey cotton or from raw silk and not from dyed or bleached yarns. Naturally such cloths are woven just the same as an ordinary material and when taken from the loom are bleached and dyed by the usual methods. Because of the method of production the colors are most always solid ones and possibly the majority of colors used are dark, black and dark blues being used extensively, although there are instances where printed patterns and light shades are used. It is however true that when the embossing or pressing is to take place the cloth contains somewhat more starch than is noted on many fabrics inasmuch as this tends to make the pattern or pressed effects of a more permanent nature.

When a satin face silk and cotton material is to be treated to an embossing process the cloth is given a

BACK STARCHING PROCESS

which allows the back of the cloth to be stiffened up in a satisfactory manner but keeps the face of the cloth free from starch and does not detract from the face lustre. This is a desirable policy inasmuch as the face is silk yarn and any amount of starch would cause the finish to be less lustrous. Of course, the pressing process is practically the last one before the cloth is folded and shipped. Sometimes there is a decided loss in yardage in the finishing process because the embossing of the cloth creates ribs or undulations thereby taking up a certain amount of the fabric and increasing the cost per yard of the finished material. Care must be used by buyers when fabrics which shrink in finishing are being handled, especially when they are being made to sell at a certain price. A comparatively small variation in the yardage received will seriously affect the profits which are obtained and in some instances is likely to cause losses.

PRICES AND PROFITS.

There is a very interesting situation noted when the selling prices of silks or fabrics woven in silk mills are compared with some of the high-class fabrics which are now being produced in cotton mills. Without doubt there are a majority of silk fabrics purchased by consumers at a smaller ratio of advance on the mill selling price than is noted on many styles of cotton fabrics. There are very many cotton cloths costing in a finished state not over 12 cents per yard which retail at approximately 35 cents per yard and often styles are shown where the advance is much greater than this amount.

There are very many silk cloths costing about 60 cents per yard to produce which are sold at retail for $1.25 per yard or less. Thus it will be seen that even though silks are more of a luxury than cottons they reach the consumer in very many instances at much more reasonable advances on the cost of production. This should never be noted in the distribution of merchandise because silks are made and sold in much smaller quantities than are cottons and not only this, but the retailer usually adds a greater amount of profit to silk cloths than he does to cotton ones. Possibly the reason why many silk cloths show a smaller rate of increase is because they go through a fewer number of hands, making smaller profits necessary.

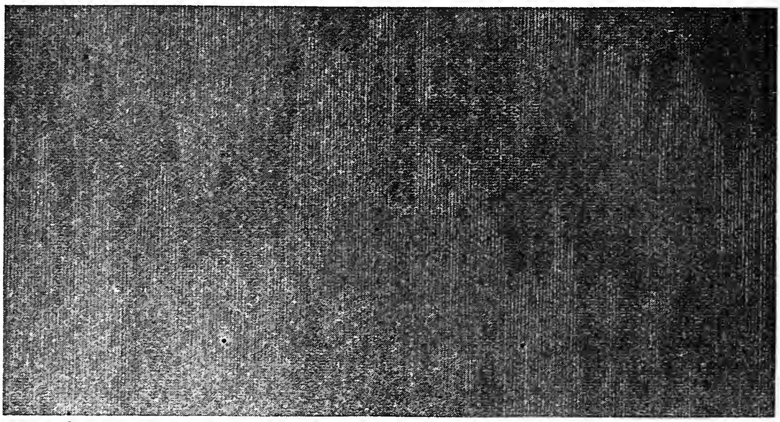
One of the great needs in the sale of cotton goods is that they be sold in a more direct manner, especially the fabrics which are not considered as staples. The converting jobber has made a start in this direction and there will be a gradual increasing sale of such cloth in this method. At present the rate of profits of this party is sometimes rather large, but as more cloth is sold in this manner

COMPETITION WILL INCREASE

and profits be smaller, and, in addition, there will be many economies effected in selling goods in this manner. It can be said that there are many lines of fancy cotton goods which are made to-day which could be produced in smaller quantities from bleached and dyed yarns and sold direct to retailers at prices which would allow a very satisfactory rate of profit. There should be a greater amount of cloth produced in this manner instead of as it is at present, with various small plants attempting to produce staples or near staples such as are woven in the larger mills.

Take the fabric for which the cost is given for an illustration. We have given the actual cotton mill cost for 30-3, but if the cloth were produced in a silk mill this yarn could not be obtained at the price which we have used, though the regular market price would not increase the total cloth cost to any great extent. Possibly this cloth would be sold at 67½ cents or less by a silk mill, and inasmuch as there is a very large demand at present the retailer is receiving a very large profit, probably as high as 100 per cent. In any case, including the retailer's high profit, the price to the consumer is only about three times the mill selling price and ordinarily would be much less than this amount, a condition not often noted when a cotton fabric is selling as well as these silk and cotton moiré materials.

There are a number of features which should be considered when a silk cloth or silk mixture cloth is being analyzed. One of the important facts is that raw silk contains a varying amount of gum which may or may not be removed when the cloth or yarn is finished. In addition, certain kinds of dyestuffs are often used which are likely to make the yarn or cloth weigh much more than when first used. Even if the cloth is not weighted through the use of dyestuffs the gum may not be entirely removed, so that the determining of the yarn size is sometimes difficult even to those familiar with the method and is usually impossible to those not familiar with conditions. In a



Sample of the Moiré Fabric Analyzed.

good many cotton and silk mixed cloths there is practically no weighting applied when the cloth is finished and the silk yarn will be lighter than when first used, though various amounts of gum are removed in finishing.

Comparatively few sizes of silk are used in large quantities in cotton mills, and for this reason it is usually possible to determine rather easily the sizes of silk used. Then a mill often finds it advantageous to use certain yarn sizes and for this reason can determine the approximate cost of a style of fabric as they will be likely to produce it. Another fact which needs careful attention is the take-up on the warp yarn in the weaving process. When a cotton warp yarn is used, a small variation in the take-up used in figuring the cloth weights will not affect the cost of the cloth greatly, but where the warp is of silk and there are a large number of threads per inch a slight difference will make quite a little variation in the costs of production.

When cotton fabrics have been pressed they usually contain quite large amounts of sizing material, and this should be removed before any accurate estimate can be made regarding the original yarn sizes. To obtain the weights of the yarns and the weight of the cloth the process is as follows: (The silk yardage used is an assumed one, but it covers the contraction in twist and offers a certain amount of protection to the cloth manufacturer.)

9,344 ends ÷ (147,500 yds.) = .0633, warp weight without take-up.
13% take-up in weaving.
.0633 ÷ .87 = .0729, total weight of warp in one yard of woven cloth.

$$\frac{56 \text{ picks} \times 36\tfrac{1}{4}'' \text{ reed width} \times 36}{36''} = 2{,}030$$

yards of filling per yard of cloth.
2,030 ÷ (30/3 × 840) = .2417, total weight of filling in one yard of woven cloth.
.0729 + .2417 = .3146, total weight per yd.
1.0000 ÷ .3146 = 3.17 yds. per lb. (grey).

PATTERN.

13/15 2 thread organzine. 9,344, total ends.
30/3 Am. carded filling, 56 picks.
64 reed, 36¼" width in reed, 36" finished width.
259 × 56 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.		
30/3 Am. carded filling; 1 1/16" staple, 6 hank dou. rov.,	13½c.	6½c.	3¼c.	=	23¼c.
13/15 2 thread organzine on beams ready to use (per lb.)				=	$5.60

COST.

9,344 ends 13/15 2 thread organzine + 13% take-up	= .0729 @ $5.60 ....=	$ .4082
56 picks 30/3 Am. carded filling	= .2417 @ 23¼c.........=	.0562
Weaving		.0353
Expenses		.0283
		$ .5280
Dyeing, finishing, etc. (about)		.0500
Selling price (about)		.6750
Retail selling price		2.0000

Yards per pound 3.17 (grey).

SLUB YARN NOVELTY

The past few years there has been a great deal of discussion regarding the large increase in the number of special cotton fabrics made and whether or not it is well to go into this kind of business in any extensive manner. Years ago, or when the domestic industry was comparatively small, the majority of mills were able to produce cloths, the best of which would be considered staples on to-day's basis of quality. Gradually the tastes of consumers advanced, and their purchasing power became larger, so that mills were able to improve the quality of their fabrics and the prices at which they sold. Then, many new mills were built which were able to make fine yarns and fancy cloths, but the size of practically all of these mills was so large that for economic reasons what might be called staple fancy cloths had to be produced, at least they are so considered when compared with many of the novelties recently offered.

Of course, there is a certain portion of high-class novelties made in large domestic mills, but they are not the fabrics which we are considering, for these are sold in small quantities, and are usually produced by specialty manufacturers. The large production of cloths which would have been considered extreme novelties only a short time ago have educated a certain number of consumers into demanding advances on previous novelties. The whole development has been one of progress, and there is no reason to believe that the recent interest is anything but logical and that it will continue to grow.

At certain periods, progress seems to be greater than at other times, due to various improvements either in manufacturing methods or else in the dyestuffs and methods of finishing, but it can be said that the results which are possible from combinations of different materials, yarn sizes, colors, weaves and finishes are just beginning to be understood in anything like a scientific manner, and that the higher range of prices makes it possible to use them in combination, whereas a short time ago their use was largely impracticable or not understood in most cases. About fifteen years ago some of the silk and cotton combinations often sold for from 75 cents to $1 a yard, while to-day they can be purchased at about 30 cents a yard in the same constructions and with a much better finish. These fabrics probably had much to do with educating consumers into higher prices for cotton goods, because previously it was the custom to purchase woolen material when the price was much over 50 cents a yard. Now it is not at all unusual to see all-cotton cloths in the stocks of exclusive retailers on which the price is from $3 to $5 a yard, and in some cases much higher.

FIELD FOR LARGE RETAILERS.

Many of such cloths are without doubt out of the reach of the small retailer, because he finds it impossible to keep up to the latest fashions, and losses are likely even though the percentage of profit added is quite large. Consumers are not inclined to purchase high-priced novelties at a small establishment, so that even though they were carried the demand would probably be very small. Then the purchase of any quantity of high-priced cloth ties up quite a little capital, and curtails the amount of ordinary stock which can be carried, this condition being liable to make an unsatisfactory merchandise situation.

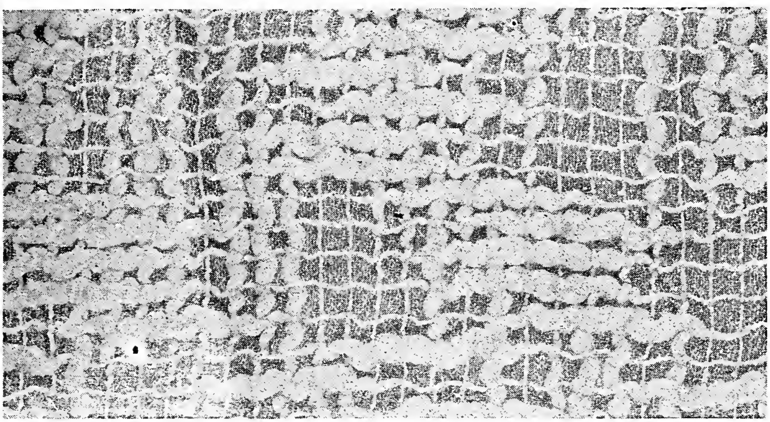
Large retailers can handle quite a few such novelties, and the possibilities of loss are much less, because the purchase of one undesirable style affects the average profits but slightly, and, moreover, the probabilities of undesirable styles being purchased is much less in the case of a large retailer, because of a greater familiarity with selling conditions and styles. Profits on such fabrics are large in some cases, but they were also large in the past upon some of the cloths which are considered staples to-day. On ordinary cloths, the price or value is partly determined by the wearing qualities, but with many of these newer lines the fabric style has much more influence on price, in fact many of such materials have comparatively little wearing value. This condition permits the making of special fabrics in a comparatively small quantity, and if desirable styles are created the price which can be obtained is practically always sufficient to allow a good profit.

Such manufacturing cannot be successfully done by any excepting men of ability, who understand thoroughly the various features of cloth making and finishing, and who also can adjust style to fabrics in an attractive and different manner. The problem does not call for the economical and systematic management necessary in large plants, mainly because changes are so frequent in styles and fabrics that each production is a problem in itself. The making of such novelties is necessarily a small business, because exclusiveness is sacrificed when quantities are made, and perhaps this feature is demanded as much as any other in the purchase of such cloths. Possibly the greatest opportunity to-day to build up a business and obtain

an exceptional profit is in producing special fabrics in small quantities. These could be sold direct to the retailer, thereby making prices to the consumer more reasonable than at first would be considered possible.

The cloth which we have illustrated offers a good idea of the methods which are sometimes used in obtaining a certain result. This fabric was without doubt produced in a comparatively small quantity, and sells at what would be considered a high price, namely $2 a yard, but when the selling price is compared with the cost of making the ratio of advance is or washed, produces the irregular ground effect which is so desirable at present.

The warp yarn is not hard twisted, because a yarn is strongest when containing practically the ordinary warp twist, namely 4.50 to 4.75 times the square root of the yarn size in turns per inch, and, naturally, a strong warp yarn aids in the weaving operation. Fine single filling of a hard twist nature when dyed is also hard to handle, so this yarn was made of two-ply instead of single, so as to aid in the cloth making. A very much heavier filling probably would not have been



The Cotton Novelty Analyzed.

probably no greater, if it is as great, as some of the more ordinary fine and fancy materials, if the excessive advances by the retailers be ignored. In the first place, the yarns used are of quite a little interest, inasmuch as they represent three different types of material.

The ordinary warp is white, and the making of this yarn is no different than for ordinary work. The size of the yarn is 60s-1. The filling yarn is two-ply of a finer size, namely, 90s-2, and, in addition to this fact, the yarn is twisted harder than it is for ordinary work. This extra twist makes the yarn have a crepey character, and when the cloth is finished so desirable, and this explains why the finer yarn was made two-ply, so that it would not differ very much from the size of the warp yarn used.

The third yarn and the one of greatest interest is the novelty yarn which is identical for warp and filling. This is made of three single threads and the bunch of soft cotton which forms the heavy portion of the yarn. There are two twisting processes employed. The method of making is somewhat as follows, considering that the single yarns, which are 15s-1, have already been completed.

A spinning frame or a similar machine, which has more than one set of rolls, is used in twisting, and an

arrangement is made whereby one set of rolls can be run intermittently. Two threads are placed in the front rolls, being separated, but not passing between the rolls which operate intermittently. Between the rolls which operate irregularly is placed a soft roving yarn, and as these rolls move forward and stop short, pieces of roving are fed out between the two threads which, when the twist is inserted by the spindles in front of the rolls, twist together, and in twisting bind in the bunch of loose cotton.

The loose cotton is not held very firmly, so the twisted yarn is then taken and again twisted, but in the opposite direction, this last twisting process binding the cotton so that it can be used satisfactorily. These yarns are used extensively in various kinds of napped goods where the bunches are of dyed cotton, thus producing quite attractive patterns. Without doubt, the yarn used in this cloth was made on an ordinary spinning frame, which was readjusted because the spacings of the bunches are almost exactly the distances which would be noted from the circumference of the ordinary spinning frame rolls.

Prices for special yarns have been exceptionally high for some time, inasmuch as few are accustomed to making them or have machinery capable of it, and the demand has been quite large. The total yarn size when completed is practically 2-¼, the three ends of 15s-1 producing a yarn equal to 5-1, and the loose cotton, which is fed in at the first twisting process, supplies the additional weight to make the above named size.

Not only are special yarns used in producing this fabric but it is also true that a good deal of ingenuity has been used in developing the weave and construction. In the first place, the crepe effect is produced by the hard twist filling, as previously noted. This crepe effect is not so great as if a larger number of turns per inch were inserted in the yarn, neither is it so great as would be noted if the heavy novelty yarn did not tend to hold out the fabric rather than to allow it to shrink in the width. The dyed yarn has been used so as to make the cotton bunches in the novelty yarn show up more prominently. A hard twist white filling would have made the result less desirable in most cases, for it would not have made the effect produced by the novelty yarn so prominent. The weave is perhaps of as great interest as the yarns which have been used.

It will be noted that the novelty yarn appears largely on the face of the cloth. This is of advantage for a number of reasons. First, it shows up the effect better, second, it does not bind down the novelty yarn, partially destroying the effect, and, third, it makes the weaving more practical, for there is less rubbing in the weaving process. We are illustrating the weave which has been used. The marks at the top and side designate the threads of novelty yarn, and we are giving a little more than one repeat of the design, so that the operation of the threads can be clearly understood.

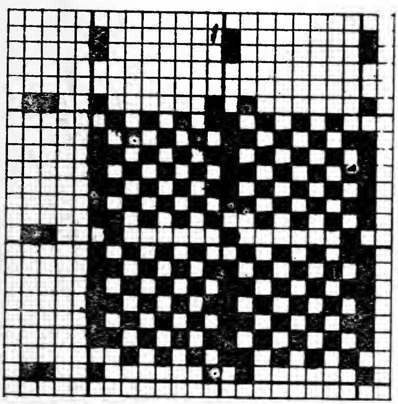
To make the effect it will be necessary to use eight harnesses, though possibly a greater number would be used because of practical reasons. Note that the novelty warp threads are lifted a large portion of the time, while the novelty filling is on the surface of the cloth in a like manner. To hold these novelty yarns in their correct places the fine warp is raised next to the novelty thread when it is lowered, and the relatively same method is adopted in regard to the filling. Note that all the novelty yarn weaves exactly the same, except that on succeeding threads or picks the weave is eight picks or threads farther advanced. One of the most troublesome features in the use of novelty yarns is the fact that what are called patterns are produced. They are present in the cloth considered, although the cloth construction is very advantageous for their partial elimination. The separation of the novelty picks and threads by a ground cloth is likely to break up the undersirable effects to a certain extent.

Because of the cloth construction a box loom is usually necessary for the weaving, but in this cloth a pick and

pick box loom must be used or one which can insert a single pick of a yarn size or color. When such a loom is being used, it is a very good plan to use two shuttles containing novelty yarn, inserting first one pick from one shuttle and then a second pick from another shuttle, for this breaks up the regularity of the nubs or bunches. A little care in planning the cloth width so that it does not correspond to the repeat of the bunches will help in obviating the trouble.

COST OF MAKING.

We have given an approximate cost of producing such a fabric as that con-



The Weave.

sidered, and it would probably be impossible for the concerns which manufacture this kind of cloth to produce at anywhere near the price which is given. In the first place we have considered that the mill making the cloth also produced the yarn used, a condition which is entirely unlikely. If yarns were purchased it is very likely that the special ones might cost nearly twice as much as the figures we have given, for there would be the extra profits resulting from the large demand, and, in addition, the various shipping and other expenses which are noted on yarns purchased, but that are not noted when the yarns are produced in the plant weaving the cloth.

The figures given are for a reasonable production, but the cost might be increased somewhat, due to very small orders. Then the expenses of experimental work can never be estimated very accurately for any one cloth, and much of this work might be necessary before the correct results were obtained. With a concern purchasing its yarn it is very likely that the cost per yard would be somewhere about 45 to 50 cents. Profits must be considerably higher per loom on such work than on ordinary fabrics, because the risk is greater, and because the small number of looms operated makes it necessary if a reasonable return is to be obtained. The demand for any style has much to do with the profit which is possible, and the variation will be wider than on ordinary cloths, because competition is not so keen. Possibly, a profit of ten cents a yard would not be exceptional for a cloth such as that considered.

AN IMPORTED FABRIC.

As this fabric is an imported one there are duties to be added to the foreign selling price, and this explains partly the high price. Assuming that the cloth was sold at 55 cents a yard, the retail price is not exceptionally high, as it is only about four times the mill selling price, and the higher cost over ordinary cloths is due to the retailer's added ratio of profit. There is a large opportunity for the development of special styles in the domestic market, inasmuch as prices to-day are quite high and are likely to continue so. There is no great reason to believe that the domestic buyers will purchase foreign goods if the domestic product is just as desirable and contains up-to-date and exclusive styles. Whether the retailer sells such novelty cloths as imported or not is of comparatively little importance to the manufacturer, because if he can obtain the bulk of such business the imported idea will be gradually eliminated, in fact it is fast being outgrown to-day.

Possibly, one of the greatest problems in making yarns of a novelty character is in obtaining the correct

cost of production. The various elements of cost should be considered carefully, such as the take-ups on the various yarns in the twisting process and their cost, and the losses which may be noted, and, in addition, care must be used in such yarns as that produced to see that correct percentages of the yarn size produced are obtained. The cost of experimentation should also be considered carefully, for this one feature sometimes will make a very much higher cost than would otherwise be thought possible.

After the correct yarn sizes are obtained, the weight of the cloth is no more difficult to obtain than for ordinary materials, although the width of the cloth in the reed must be carefully ascertained, because there is quite a large shrinkage in this direction. Probably there are very few fabrics selling to-day which illustrate any better some of the extreme ideas which are being successfully adapted to high-class production on the cloth we have presented.

PATTERN WARP.

60/1 Am. combed bleached	$\frac{3}{24}$	4	3	$\frac{3}{24}$	=	1,985	
2¼ novelty		1			=	263	
		$\underbrace{\quad}_{263\times}$				2,248	total ends.

PATTERN FILLING.

90/2 Am. combed dyed	7	
2¼ novelty		1
48 picks per inch.		

YARN COST.

60/1 bleached	52c. per lb.
90/2 dyed, extra twist	91c. per lb.
2¼ novelty (3 ends 15/1 and roving; 2 twisting operations)	24c. per lb.

CLOTH COST.

1,985 ends 60/1 bleached	+ 8% take-up	= .0427 @ 52c.	=	$ .0222
263 ends 2¼ novelty	+ 2% take-up	= .1419 @ 24c.	=	.0340
42 picks 90/2 dyed		= .0600 @ 91c.	=	.0546
6 picks 2¼ novelty		= .1714 @ 24c.	=	.0412
Weaving				.0705
Expenses				.0214
				$ .2439
Finishing, etc.				.0250
Mill cost under most favorable circumstances				$ .2689

Yards per pound, 2.40 finished.

MERCERIZED CORD

A new fabric which is now being offered for the first time in the finished state by retailers is the mercerized corded fabric, of which we are giving an analysis, and of which an illustration is presented. For a number of years, corded fabrics have been quite large sellers, and the lines have included Russian cords and Bedford cords in various combinations and colors, and on both light and heavy ground fabrics. The yarns used in making these cloths have been of widely varying sizes and qualities, although, as a general thing, the yarns used in Bedford cords have been of rather fine sizes, and the cloth count has been comparatively high, at least when compared with most lines of cotton goods. Russian cords being an addition to a fabric, rather than a component part of it, have been applied to all kinds of materials, although because of the additional cost, the idea has been used more extensively on high quality merchandise which sells at a rather high price. The extensive sale of these two lines has made consumers familiar with such styles, but competition has become more keen than it was, and for this reason, the profit obtainable on the above two fabrics is smaller than it was.

As usually happens with fancy cloths or new styles, a change has to be made through the use of additional cloth features, or by lower prices so as to make the cloth desirable for

a longer time, although, naturally, other fabrics will be developed, and take the place of some former styles. Voiles were sold in large quantities in the plain state when they were first developed, and gradually novelty features had to be added, such as crowded stripes, checks and silk stripes with jacquard figures, in order to keep up the distribution. The same thing has happened on poplins, and is now taking place on fabrics composed of novelty yarns, and the same condition will be noted on fancy fabrics which are in demand in the future. Of course, all kinds of voiles are still being sold, and so are poplins and other cloths which formerly sold well, but this is mainly because they are desirable to many consumers, although the above statements apply generally to the whole development in the sale of fancy fabrics.

The corded fabric now being offered has been made so as to take the place of certain of the Russian and Bedford cords, inasmuch as the demand for these has been declining. The reason why it can be sold is partly because it can be made at a comparatively low price, and partly because the cloth contains some new ideas. In a general way, corded fabrics are used for all the purposes for which medium-weight cotton cloth is desirable, although, possibly, waistings, shirtings and dress materials form the largest portions of the sale. The cloth we have analyzed is rather stiff for some uses, mainly because there are so many cords in the material, but other patterns contain fewer cords, and would be possibly considered more desirable for ordinary use by many consumers.

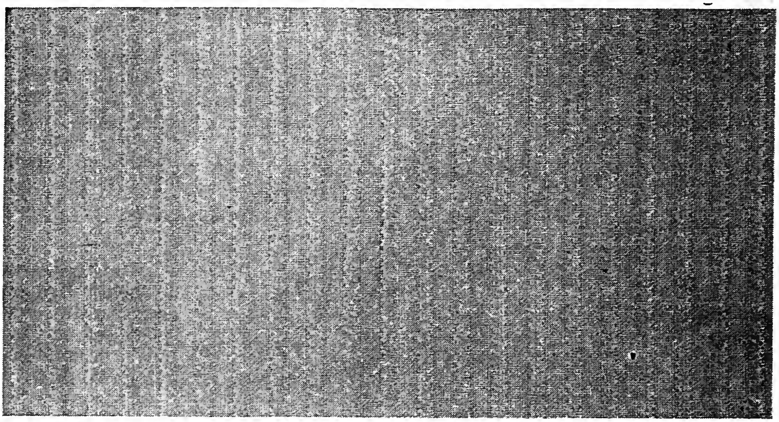
Inasmuch as the cloth is mercerized in the finishing process, the planning of the construction involves much the same principles as noted when making an ordinary mercerized fabric, that is, a soft twist filling yarn, and a greater number of picks than threads so as to produce a more lustrous effect when mercerized. This method of making cloth is usually designated as a soisette construction. When the warp is to be treated, the same conditions apply, only it is impossible to weave a soft twist single warp yarn, and to obtain satisfactory results, the warp is made of fine yarn, and the single yarns twisted into a two-ply form with a comparatively few turns per inch. One of the constructions which is largely used when the filling is to be mercerized is a count of 64 x 72, and with 50-1 warp, and 30-1 soft twist filling, while when the warp is to be mercerized the most common construction used is 100 x 48, with 60-2 soft twist warp and 25-1 filling. The yarns will vary slightly in different mills, but the general results are very similar. The ground construction which has been used in the cloth analyzed is 74 x 96, with 50-1 warp and 30-1 filling. Many fine mercerized fabrics have a count of 72 x 104, with 70-1 or 80-1 warp and 40-1 soft twist filling. Thus, it will be noted that the well-known idea of fabric construction has been followed, but that a slightly lower filling count has been used, together with yarns about the same as in the lower count mercerized fabric previously mentioned.

THE COARSER SIZES.

The coarser sizes of yarns used more than offset the slightly lower filling count, so that a rather firm fabric results, and the construction would not be used were the fabric to be made entirely of plain weave. The reason why these coarse yarns have been used is to make a satisfactory fabric when the large number of cords have been introduced. These are so large that with the ordinary fine yarn constructions they would undoubtedly slip in the material, and produce an undesirable result. Another feature which is worthy of note is in regard to the weave, which has been applied to the cords. On most fabrics, when an ordinary cord is used, the cord will weave just the same as the threads in a plain cloth, namely, be raised for one pick, and depressed for the following one, while in this cloth, the cord is raised for one pick, and depressed for the following two picks. This causes the filling to float over the cords two-thirds of the time, and partially covers them up, acting in a similar manner to the crossing thread in a leno weave in a fabric containing the Russian cord. The method of

weaving makes a rather soft cord, which will not wear out the picks of filling so rapidly when it is washed and ironed, as if it had been bound in more firmly, but the cord does not stand out so sharply as when produced by the leno weave.

This fabric in a large majority of instances should be classed among fancy materials, and as a fancy mill product. There are various reasons why this should be so, and probably the first is that the yarns all vary so much in size and character. Few cloth mills, excepting those making fancy materials, produce any soft twist filling. Second, some of the yarns are made of combed stock. There are mills which make combed yarn fabrics with what might be called plain weaves, but most of them use no ply yarn at all in any of their constructions and in few instances do they produce very heavy cloths. Third, because of the weave which has been used. This is a comparatively simple one, but it would not be liable to be woven on a cam loom or on other looms making simple effects, but rather in a fancy cloth mill where dobby looms are available. Fourth, such a construction would not be desirable for some mills, mainly because the demand for the cloth would not last. Even if a mill might be able to produce such a fabric, it is entirely probable that changes to a more fancy cloth would soon take place, eliminating the demand and causing a mill to be short of orders. This is one great reason why staple cloth makers are so seldom desirous of changing from their regular fabrics even if the possibilities of profit appear somewhat greater when the demand is at its best. There are in addition the mechanical and labor troubles which often deter certain manufacturers from making lines of fabrics which are different from those which they regularly produce. Such troubles include such items as incorrect gears for frames and unbalanced mill organization with too few or too many frames of certain kinds, reeds which are not suitable for the cloth count which is to be made or if new ones are purchased they are likely to spoil through subsequent standing without being used. Other features also might be added to those enumerated. Regarding the labor difficulties it can be said that sometimes there are too few or too many employes, if changes in product are to be made, and what is more of importance it usually happens that a change means that more complicated constructions or weaves are to be used, and inasmuch as the help is unused to changes, time will be lost and percentages of production decline over nor-



Mercerized Cord.

mal, and in addition the number of seconds are likely to increase, thus making the actual profits less than appearances would indicate if a cloth were to be continually woven. These fabrics are practically never produced on automatic looms, because very few fancy mills contain any such equipment and also because the quality of the cloth has to be somewhat better than is produced by such methods.

It is very probable that the heavy cord is placed on more than a single harness because of the weight of yarn which has to be lifted, although so far as the weave is concerned a single harness would be sufficient. When the warp is drawn in and reeded it is necessary to place the cord in two separate heddles and dents so as to make them weave satisfactorily, and this is also another reason why the cord would be placed on two harnesses which weave the same.

Whenever a new idea is developed, either in connection with a fabric's construction, finish or both, it is very likely that a good profit is obtained therefor. Usually there will be a greater or less amount of competition afterward and these first high profits will be reduced so that it might be said that on some few fabrics manufacturers dictate the selling prices. Most grey fabrics have a good deal of competition regarding prices, and this keeps excessive profits at comparatively low levels. For all fabrics excepting those which are especially new, a manufacturer should have a comparatively accurate idea regarding the profits which each cloth should carry. These profits should be determined somewhat by the investment in the mill organization, although, of course, manufacturing ability has much to do with the success of one mill and the failure of another, and a good deal depends upon the demand. A good many manufacturers have a general idea regarding the total profits they believe they should obtain, but often they are not especially particular in the methods they adopt in setting prices so that their various prices will all bear the same proportion of the total profit.

Some figure out in a comparatively accurate manner the net cost of their goods, adding to this cost an arbitrary amount as the profit. This arbitrary amount is obtained by dividing the total estimated profit by the total yardage produced. For a mill which makes only one kind of cloth, such a method is entirely satisfactory, but for a mill which produces quite a number of constructions this method is incorrect, and the various cloths are likely to be quoted at wrong prices. This allows other sellers to obtain business which the mill producing the cloth should have obtained and makes a low price with small profits or forces the market on other fabrics.

Of course, it might be said that competitors regulate a mill's prices and this is true on certain lines to an extent which is greater on grey goods than it is on dyed yarn fabrics, but nevertheless many goods are sold on prices which are entirely designated by the sellers. The profits should be based on the relative production of the producing unit, viz., the looms. If one cloth averages to produce at the rate of 100 yards per week, while another produces at the rate of 200 yards per week, it is incorrect to expect that each cloth must return the same profit per yard to the manufacturer. We have used the weekly basis of production, inasmuch as most mill reports are submitted in such form. The production of any cloth is based on the speed of the loom, the picks per inch in the cloth, and the actual percentage which is obtained when compared with the theoretical one. Such results are available only after careful investigation, and the keeping of accurate records. A loom might actually produce when the warp is in the frame at the rate of 85 per cent, but due to changing or waiting for warps or other features, the production rate might fall to 80 per cent, or less, over the space of a year's time. To base the production and profits on a high rate would be to receive a smaller profit than expected and to name a price too low on the cloth. For example, suppose a mill cost $1,000,000, and contains 1,200 looms. It is desired to obtain a rate of 12 per cent net profit. This is $120,000 per year,

or approximately $2,300 per week. When this amount is placed on a loom or production basis, the net profit which must be obtained per loom per week is approximately $1.92. A certain style of cloth is being made, and by careful records, it is found that the cloth will be produced at the rate of 132 yards per week average. With the two items we have obtained, namely, $1.92 profit per loom per week, and 132 yards average production per week, the amount each yard of cloth should carry as profit is easily ascertained. $1.92 divided by 132 yards equals 1.45 cents per yard profit. The same method can be adopted with the various styles which are running, and if a new cloth is to be made on which a price has to be named, careful comparison should be made with previous styles, so that no radically incorrect estimates are made regarding the amount of cloth which will be produced. If the above method was used in connection with a correct cloth cost, it is certain that it would eliminate some of the fabrics which are now sold at unreasonably high or low quotations in not alone cotton cloths, but also in other materials, and give a better idea to manufacturers as to what their profit was likely to be.

This fabric has been made with a certain purpose in view, that is, of being mercerized before it has to be sold. Some cloths are mercerized after they are bleached, but in the majority of cases, it is probable that they are mercerized before the bleaching takes place. The fabric is also piece dyed in various colors, these depending upon the tastes of the buyers and the styles of the season. A few of the features which aid in the mercerization process may be of interest.

A comparatively few years ago, it was considered that mercerization did not affect the short cotton fibres as much as it did the longer ones. This was due more to mechanical difficulties than to actual theory. The lustre on cotton fibres when mercerized is obtained because the fibres become more or less like small glass rods and reflect the light, and inasmuch as long cotton fibres when used in yarn permitted a lower standard of twist with straighter fibres, it appeared as if the longer fibres gave better results than the shorter ones. When soft twist filling is being used, it is customary to comb the cotton so as to produce a better yarn, and this allows a lower standard of twist, with less twisting of the fibres and a more lustrous result when the fabric is mercerized.

THE PROCESS IMPROVED.

The process has been improved a great deal through extensive use, and although combed yarn produced from long staple cotton still shows the best results, the process is being applied very extensively to many fabrics made of carded yarns. Reduction in prices has made this possible, inasmuch as it permits the obtaining of a higher price for the cloth. The price of mercerizing and dyeing a fabric such as that considered will vary somewhat with different concerns, but for ordinary fabrics, the price is about one and one-half cents per yard. The cloth is much heavier than the ground construction and the yarns used would indicate, because the cords add quite a little weight to the cloth. There is quite a little take-up on the fine warp yarn, due to the large number of picks of filling, but on the cords there is comparatively little take-up, the amount given being partly the loss which is due to the various processes. The heavy cords affect the stretch of the cloth to a certain extent, and there will not be such a large gain in finishing as would be noted were the cloth made entirely plain and with no cords. The method of finding the various weights of the yarns used, and the total weight of the cloth is as follows:

1,452 ends ÷ (50/1 × 480) = .0346, weight of fine warp without take-up.
11% take-up in weaving.
.0346 ÷ .89 = .0389, total weight of fine warp per yard of woven cloth.
846 ends ÷ (20/2 × 840) = .1007, weight of ply warp without take-up.
2% take-up in weaving.
.1007 ÷ .98 = .1028, total weight of ply warp per yard of woven cloth.

$$\frac{96 \text{ picks} \times 29\tfrac{1}{3}'' \text{ reed width} \times 36''}{36''} = 2.816$$

yds. of filling per yard of cloth.
2,816 ÷ (30/1 × 840) = .1117, total weight of filling per yard of cloth.
.0389 + .1028 + .1117 = .2534, total weight per yard.
1.0000 ÷ .2534 = 3.95 yards per pound (grey).

MERCERIZED CORD.

PATTERN.

50/1 Am. combed warp	$\frac{2}{10}$	6	4	2	$\frac{2}{10}$	=	1,452
20/2 Am. carded warp		$\underbrace{6}_{141\times}$				=	846
							2,298 total ends.

30/1 Am. combed filling, soft twist, 96 picks.
34 reed; 29⅓" reed width; 27" grey width, 26½"-27" finished width.
74 X 96 ground count grey; 85 X 94 over all count finished.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
50/1 Am. combed warp, 1 5-16" staple; 10 hank dou. rov.,	21c.	16½c.		= 37½c.
20/2 Am. carded warp, 1 1/16" staple; 4 hank dou. rov.,	13½c.	4½c.	¾c.	= 18¾c.
30/1 Am. combed filling, 1⅛" staple; 7 hank dou. rov.,	15c.	8½c.		= 23½c.

COST.

1,452 ends 50/1 Am. combed warp + 11% take-up = .0389 @ 37½c. =	$ .0146
846 ends 20/2 Am. carded warp + 2% take-up = .1028 @ 18¾c. =	.0193
96 picks 30/1 Am. combed filling, soft twist = .1117 @ 23½c. =	.0263
Weaving	.0141
Expenses	.0161
	$ .0904
Selling	.0018
Net mill cost (grey)	$ .0922
Selling price to converter or mill selling price (grey)	.1050
Bleaching, mercerizing, dyeing, etc.	.0150
Cost to converter (not including expenses)	.1200
Cost to jobber	.1375
Cost to retailer	.1750
Cost to consumer	.2500

Yards per pound 3.95 (grey).

NEW SILK AND COTTON FABRICS

Possibly no class of fabrics produced in cotton mills has been of more interest to buyers than the silk and cotton materials which have recently been selling, and on which mills have orders for as long future dating as any other kind of fancy fabric. That there has been a phenomenal growth in the sales of such cloth is generally well known in the trade, but few consider how comparatively recent the growth has been, and why such results have occurred. It might be well to state that the foreign development has not been nearly so rapid, when such lines are considered, as has the domestic, and therefore quite a good many silk and cotton fabrics are exported to-day, although the reason for exportation is probably not because of lower costs of production, although this has an influence on the sale, but rather due to the fact that foreign mills have produced comparatively few such goods, and their finish is not so desirable as that of the domestic cloth.

There is no reason why many domestic mills could not have produced such goods quite a long time ago, because the machinery necessary was available, although not so extensive as to-day, and is no different than that used in making ordinary fancy cotton cloths, but due to inexperience in handling silk yarn and other reasons, their production was attempted by only a few mills. Probably the biggest reason why few of such cloths were produced was because the demand had not been developed to any great extent. Until consumers become used to any fabric, it is very likely that the sale will be comparatively small. At first the quantities made were small, and the profits of practically all sellers were large, but through inexperience in finishing the results were in no way comparable to that of the fabric sold at present.

Many of the cloths now selling at 25 cents to 29 cents per yard were formerly sold at from 75 cents to $1 per yard, and the finish, or color, was not nearly so desirable as it is to-day, these facts indicating the progress which has taken place, and showing that consumers are obtaining much more value than they formerly did.

Inasmuch as these silk and cotton materials offer possibilities in finishing and weave effects not noted on entire cotton cloths, it would naturally be expected that they would become a staple article by the present time. Up to about three years ago the development of the demand indicated that they were fast becoming staples, for they were sold at reasonable prices, and filled a need which neither all silk nor all cotton could. Then a greater number of converters became acquainted with the fabric construction, and in order to beat their competitors, they began to order from the manufacturers' fabrics on which the construction was not so high as it formerly was. If a buyer desired a low construction it was of little importance to the manufacturer, so long as a legitimate profit was secured in the cloth making, and gradually the constructions which had been found satisfactory were cut until little real worth was left in the materials. This could easily be done, because the cloth effect is not changed very much through the use of a smaller number of picks, the difference being noted in the fabric wear.

We are acquainted with instances where the buyer purchased three widely varying constructions in a silk and cotton cloth with the same number of warp threads per inch, but with a different number of picks of silk filling per inch. Upon these different fabric constructions was placed the same designs, as near as was possible, and through such methods buyers were deceived in the quality of the goods which they received. It is entirely probable that the cloth prices for the various styles differed somewhat, but undoubtedly the parties who purchased the cloths delivered last received far less value than those who bought the ones first offered. The highest count cloth was delivered first, and gradually the cheaper cloths were substituted until conditions became such that there was general dissatisfaction, with a resulting radical falling off in the demand. Naturally, the well-made fabrics of certain houses suffered in the decline along with the poor materials, and much of the cloth was sold at retail at prices which must have represented large losses to some of the sellers.

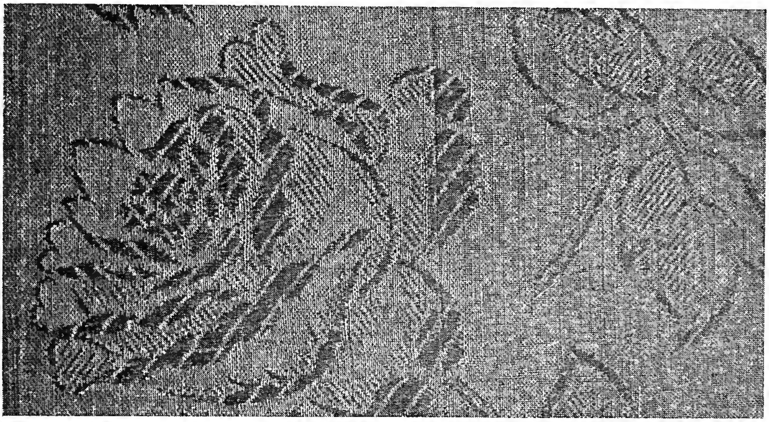
Such combinations of material were, however, of too much value to consumers to be long neglected, and a comparatively new start was made which has now become of large volume, but it is well to note that the sale has been made on satisfactory combinations, and that most of the newer lines are decidedly well made. Of course, the greater weight of silk used results in a greater cost, but it gives much better wear and a more desirable appearance. These cloths are used largely for dresses, but the other uses are such that the demand is quite large and an extensive production is possible at the mill.

One fact which is of importance, and which is going to affect other lines, is that many of the new materials are being produced with a width of 36 inches. This method allows the cloth to be produced at about the same mill cost as would be noted for a narrower fabric, with the exception of the additional material necessary in making the wider width. Most of the looms which are capable of producing such goods can weave cloth at least 36 inches wide, and the production of any narrower material is a mill waste which should not be permitted. The reason why the narrower fabrics were produced was partly because the demand in the past had been for narrow fabrics and partly because it allowed various sellers to obtain the cloth to sell within certain set price limits.

In a general way there are two kinds of silk used in making the class of fabrics we are considering, namely, Canton and Tussah. The silk sizes will vary somewhat, depending upon the fabric which is to be produced,

but by far the largest quantities are of 32-38 two-thread Tussah and of 14-16 two-thread Canton. Most of the silks used are two-thread, although 22-26 Canton is used in place of the 14-16 two-thread, as it is somewhat finer and allows a slightly lower cost of production, although the resulting cloth is not quite so desirable as when the heavier two-thread silk is used.

Recently, there has been quite a little three-thread silk used both in Canton and also in Tussah, but the general tendency has been to increase the number of picks in the cloth rather than to change the size of the silk used. Few of these silk and cotton warp is used in the majority of instances, although quite large quantities of cloth have been produced with a somewhat finer size of warp. When the 60s-1 warp is used, the cloth construction is often about 96 x 100. It will be noted that the cloth analyzed contains 40s-1 warp with a somewhat smaller number of picks, but that the use of the three-thread material more than offsets the small number of picks, thus making a much better construction, so far as service is concerned. In obtaining our cloth weight we have used a yardage of 90,000 for the silk, although this is not the correct theoretical yardage. This has been



Fancy Silk and Cotton Fabric.

cloths contain warp coarser than 40s-1, and usually, although not always, the cotton yarn is produced from combed stock. Inasmuch as the Tussah silk is rather coarse in size, it is used with the coarse cotton yarns, probably most of such fabrics containing 40s-1 or thereabouts, while the cloth construction is often about 72 x 68. Oftentimes this construction has to be changed because of a fancy ground weave in the cloth, and unless more threads or picks be used, the firmness in the fabric will not be sufficient to allow satisfactory wear.

For the fabrics in which Canton silk is used it is probable that a 60s-1 done so as to allow a certain amount of protection to the manufacturer, inasmuch as the silk size is likely to vary. Tests should be made when silk or any other yarn is being purchased, in order to determine accurately the sizes, so that there will be no mistake when the cloth cost is figured. This is especially true when the yarn is high in price.

There are a certain amount of silk and cotton materials, such as those considered, which are woven with a plain weave, and a somewhat larger quantity made wherein dobby weaves are used, but without doubt the fabrics which contain jacquard figures

are made in larger quantities and are of much more interest at present. This is more true than it has been in the past, for the demand for brocades has made large figures desirable, and these cannot be satisfactorily produced except on jacquard looms. The principle of operation is no different than on ordinary plain looms, although the repeat of the weave is on two threads, while when a jacquard mechanism is used it may be 400, 600 or whatever number of threads the mechanism is made for. The first thing in duplicating a piece of cloth is to obtain the number of threads and picks per inch by counting with a pick glass or by cutting out a piece of cloth with a die and counting the threads. In this cloth there are 92 threads and 70 picks per inch when finished.

Through the stretch of the filling it is easy enough to obtain approximately the width of the cloth in the reed, and from this the

SIZE OF THE REED

which was used in producing the cloth. Using a few lengths of filling pulled out from a piece of the cloth we obtain the following:

5½" : 5⅞" :: 35½" : X.

This will give the real width as approximately 38 inches. Then we have:

35½" cloth width : 38" reed width :: X : 92 threads.

This result shows that there are 86 threads per inch in the reed, and with two threads per dent a 43-reed will be used. It is assumed that the buyer has supplied the cloth sketch from which the weave design is to be produced. Possibly, this cloth was made on a 400-jacquard machine, which has eight hooks in a row, and for such a machine the correct design or point paper would be obtained as follows:

92 (the finished warp count) : 70 (the finished filing count) :: 8 : X.

This will result in a design paper being used of eight squares in the warp and six in the filling direction. If a 400-machine were used for this cloth, there would be no cast-out, and the small sketch would be ruled up into 50 equal divisions, each division corresponding to one block on the design or point paper. This cloth sketch is also ruled off horizontally to correspond with the vertical spaces.

The next step is to transfer the cloth sketch to the point paper, keeping the general features as nearly identical as possible. When this has been done, the cloth weave is painted in on the point paper, introducing different combinations to produce the various effects. Care must be exercised that no long floats are allowed to remain, for often the results are spoiled, because attention has not been paid to such details. From this finished design jacquard cards are cut which operate the loom mechanism. Each small square on the design is represented by a blank space or a punched hole in the card, and the 400 needles (50 rows, eight in a row) correspond to the spaces on the card. Each card represents one pick of the design, and the number of cards corresponds to the total number of picks in the design. In the fabric considerd there would be approximately 440 picks in the design, and the same number of cards on the loom. The operation of these cards against the needles in the jacquard head either raises or depresses the harnesses which contain the eyes through which the warp yarn is drawn, and the action of the different cards produces the pattern when the filling is inserted. The above is a general description of the process which is noted when a sample piece containing a fancy pattern is to be produced.

When an order is received, the original set of cards is duplicated as many times as there are looms to be operated. The lacing of the various cards is performed by a lacing machine which acts in a similar manner to an ordinary sewing machine, binding the cards at the ends and in the centre. It might be imagined that on a silk and cotton fabric such as that considered there would be a smaller num-

ber of looms per weaver than on somewhat simpler dobby patterns, but such is not the case, for in most instances the same number of looms are operated as when dobby patterns are being made. Some have considered that the percentage of production would not be so high when silk filling is used, but through experience it has been found that the percentage of production is somewhat higher than for similar cloths which contain cotton filling. It is, however, true that a weaver will not produce so much cloth as when dobby patterns are being made, but this is because of the slower loom speed rather than because of the more complicated weave placed on the cloth. The cost of producing a design such as that used on the cloth analyzed is not so great as many might believe.

The general method is to charge a certain price per pick when outside parties accomplish the work, the cost to the mill when done at the plant being about half the outside prices. The prices per pick will vary up to 7½ cents per pick, but this is for a high count and complicated ground weaves. A design such as that used would cost about $7.50, this small sum influencing the cloth cost per yard very slightly when the orders received are of any size. In the majority of designs for silk and cotton cloths, where the filling is of silk, it is customary to produce the effect largely by floating the filling, for this allows the lustrous yarn to form the figure, and makes the results more desirable. Plain weave forms the groundwork of the fabric in the large majority of instances, and is necessary if a firm cloth be produced with the comparatively fine sizes of yarns used.

PROFITS AND FINISHING.

Possibly a few items regarding the profits secured by the various sellers may be of interest. With the production which the loom is likely to make, and the profit per yard which we have estimated, the profit per loom per week would be $2.90, or approximately $150 per loom per year. This amount should be responsible for at least a 15 per cent profit to the manufacturer. It must be remembered that the manufacturer has quite a little money invested in his plant and machinery, usually upwards of $1,000 per loom, which is of comparatively little value if it is not being operated, and for this reason he is on a much different basis than the succeeding sellers.

The converter obtains a net profit of approximately 2¾ cents per yard, and this should return him a profit of about 11 per cent, with only a single turnover of his goods per year, but this profit must be compared with a mill profit of 15 per cent, where an outlay of from $800 to $1,000 per loom is made, with only a converter's outlay on the cloth purchased, which in this case is practically 24¾ cents per yard. The jobber is in much the same position as the converter, and his profit is somewhat similar, due to his greater turnover. The retailer on this cloth, will obtain a gross profit of about 50 per cent, and allowing 25 per cent, which is not far from correct on to-day's basis for his various expenses, the net profit secured is practically 25 per cent, but it must be noted that a retailer turns over his goods a number of times a year. Usually, the number of turnovers is more than three, so adopting this as a basis, it will be seen that, instead of obtaining the 25 per cent mentioned above, he will be receiving 75 per cent. There has been quite a large profit on many of the new cotton mill products, because the sale has recently increased, thus making the cost of distribution lower and the profits higher. Such fabrics as that considered are first bleached, and then usually piece dyed in some popular shade.

THE BLEACHING

must be done by a chemical which will harm neither the silk nor the cotton. Some seasons printed patterns are used when the fabrics are sold in the white state, although recently the demand has not been large for such styles. The price for finishing and dyeing will vary somewhat, but probably three cents a yard will give a general idea as to the price for cloth such as that considered. The

silk is usually quite a little lighter in the finished cloth than it is when woven, because there is a certain amount of gum in the silk yarn, which gum is partly removed when the cloth is bleached and finished and the small amount of starch which is added in the finishing operation does not counteract the loss of weight in the finishing process.

These cloths are finished out practically to their grey width as they come from the loom. Sometimes the cloth is cross dyed with the silk one color, and with the cotton another while at other times the cotton will be dyed, and the silk will remain white, so as to form a contrast. When the sizes of silk used by cotton mills are known, the analysis of a silk and cotton cloth presents no great amount of difficulty, inasmuch as the weights are obtained just the same as when an all-cotton cloth is being treated. The method of obtaining the cloth and yarn weights is as follows. (The size of the silk used as mentioned previously is 90,000 yards per pound, and is not the theoretical yardage, although a manufacturer can substitute the actual size which he finds his silk to be in obtaining his correct weights.)

3,300 ends ÷ (40/1 × 840) = .0982, weight of warp yarn per yard without take-up.
6% take-up in weaving.
.0982 ÷ .94 = .1045, total weight of warp yarn per yard of woven cloth.

$$\frac{72 \text{ picks per inch} \times 38'' \text{ reed width} \times 36''}{36''} =$$

2,736 yards of filling per yard of cloth.
2,736 ÷ 90,000 (silk yardage) = .0304, weight of silk filling per yard of cloth.
.1045 + .0304 = .1349, total weight per yard.
1.0000 ÷ .1349 = 7.41 yards per pound (grey).

PATTERN.

40/1 Am. combed warp $\frac{2}{16}$ 3,236 $\frac{2}{16}$ = 3,300 total ends.
14/16 Dernier 3 thread Canton silk; 72 picks.
43 reed; 38" reed width; 36" grey width; 35½-36" finished width.
91 × 72 grey count; 92 × 70 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	
40/1 Am. combed warp; 1⅛" staple; 8 hank dou. rov.,	15c.	11⅞c.	= 26⅞c.
14/16 3 thread Canton silk; 90,000 yds. per lb. Ready on quills			= $3.80

COST.

3,300 ends 40/1 Am. combed warp + 6% take-up = .1045 @ 26⅞c. =	$ .0281
72 picks 14/16 3 thread Canton filling = .0304 @ $3.80 =	.1155
Weaving	.0122
Expenses	.0167
	$ .1725
Selling (grey)	.0035
Mill cost (grey)	$ .1760
Converter's purchasing price from mill (about)	.1950
Finishing and converter's expenses	.0525
Cost to converter	.2475
Cost to jobber	.2750
Cost to retailer	.3250
Cost to consumer	.4800

Yards per pound 7.41 (grey).

NOVELTY YARN STRIPED CREPE

That there has been a great improvement in the fancy cotton fabrics produced in domestic mills is well recognized by any one who is at all familiar with selling conditions. This improvement includes not only the styling of the fabric, but also the quality of the yarns from which the cloths are woven. It may be that the class of fabrics which have been selling for the past few years has had much to do with the better appearance, but without doubt a part at least of the improvement is due to the natural progress of a rapidly growing industry, and a part to the increased experience obtained from a

freer interchange of manufacturing and finishing knowledge.

A very good illustration of this progress is shown in the development of voile cloths. When these were first produced extensively in cotton, the constructions were not entirely suitable, and the yarns were often irregular and detracted much from the finished results. Gradually mills became accustomed to making such fabrics, and were able to determine the correct amount of twist and the right combinations to use in producing a good article, and in order for other mills to obtain business they had to produce better yarn, if they secured many orders on these fabrics, especially if the cloth was considered high class, and was to be sold at a comparatively high price.

The use of silk yarn in voile fabrics often showed up cotton yarn irregularities through contrast, and for this reason forced the production of better yarns. When the demand for voiles began to grow less, the interest of buyers on novelty yarn fabrics increased. In many of these materials, the irregular appearance permitted the use of comparatively poor yarn, but the competition which developed and style changes have made it necessary to use much care if the best results be produced. Similar conditions have been noted on crepes, and although the finished fabrics are rather irregular in appearance, the yarns must be better than for certain other similar weight materials, because the construction is low, and irregularities appear prominently. Possibly, the ideas which are being used most extensively at present for fancy cotton fabrics are novelty yarns and crepe effects. Cloths made by such methods are used extensively for dresses, although there are other uses, and for this reason, a wide distribution is possible. We are illustrating a garment which is made from one of the newer fabrics, and which contains ideas somewhat similar to those in the fabric analyzed, and shows in a general way the results possible. Because light ground cloths have sold well, the use of novelty yarns has been of advantage, inasmuch as their heavy size has allowed much contrast to be developed, and has made it possible for effects to be produced, which at other times would be considered undesirable.

One of the most important features in connection with the use of novelty yarns, and one which has not been mentioned to any great extent is that the variety and combinations which are possible in fabrics made from them are more extensive than any other class of cotton cloths formerly produced. A short investigation into the stock of fabrics carried by any large retailer will clearly demonstrate the above fact. Consumers desire to have a great deal of variety in dress materials, even though they do cling to general styles when they are being used, and the use of novelty yarns affords an opportunity seldom experienced. Probably most every novelty yarn fabric is different in some essential respect from other similar cloths, even though the general cloth appearance is duplicated.

The combination of yarn sizes, the twist per inch in the yarn, and the cloth count, all have a greater result on cloth effects than they are likely to have when ordinary materials are being manufactured. The fact that a mill has to use machinery and yarns available is also likely to affect the result obtained. In addition to the wide range of effects possible from similar yarns, there are the different methods of twisting, such as loop, nub, corkscrew, slub and various other ideas, both separately and in combination. In all these ideas, it is possible not only to use different sizes and twists of yarn, but also to use various colors, and in some cases various combinations of materials. All these facts are responsible for a greater variety of styles than have ever before been possible, and have been the means of

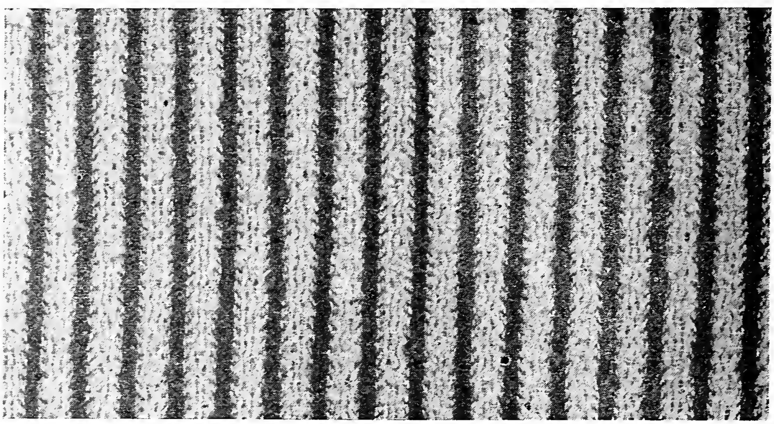
EDUCATING MILL MEN

in regard to the developing of fabrics.

When novelty yarn cloths first began to appear, a large majority of mill men would have, and did, state positively that they could not be made in most domestic mills. It is true that a

small proportion of them cannot be so made, but during the past two years many mill men who were formerly positive regarding this point have found out that they can be successfully produced, and with comparatively no changes in the machinery of an ordinary mill. The reason these men believed such yarns could not be made was due to unfamiliarity with the subject, and because many of them were operating in a rut through the manufacture of a comparatively few styles of cloth, and no changes year in and year out.

Practically the entire range of effects are produced through the character of the yarn, and up to the present, very few attempts have been made to use any fancy weaves. Recently, the combination of novelty yarn with other fabrics has allowed a greater possibility in this direction, and certain of the styles which have been developed for next season's use contain simple weaves, which aid in the result, although in most cases the prominent feature is the effect produced through the yarn. Naturally, the size of the novelty yarn precludes any great use of various weaves, for they would not be visible at all, and in most instances the weaves which are used are for the purpose of making the novelty yarn more prominent. This is true in the fabric analyzed where an ordinary four-harness twill has been used with the novelty yarn on the face of the cloth, in order to make it more prominent. In certain other similar lines, somewhat similar methods are being used to show up the novelty yarn effects.



One of the Popular Novelty Yarn Crepes.

NOVELTY YARN MAKING.

The novelty yarn used in the fabric analyzed represents very well the general characteristics of most of such materials. It is produced by no special machinery, and can be made by any mill from ordinary yarns. Two twisting processes are employed, one being in one direction and the other in the reverse direction. There are six strands of yarn employed, although in some instances fewer are used to produce similar effects. If special twisters containing two sets of rolls and operating at different speeds are not available, an ordinary spinning frame can be used instead. For the yarn considered in the first twisting process, the ground threads (two ends of 50-1) are placed in one set of rolls, while the loop yarn (two ends of 30-1) are placed in a second set of rolls.

The speed of the rolls containing

the 30-1 is practically twice as fast as the rolls delivering 50-1. For this reason, when the yarn is being twisted, the extra 30-1 yarn winds around the 50-1 ground threads, and is not held tightly enough to allow it to be satisfactorily used. Quite a little twist is inserted, inasmuch as a portion of this twist is taken out in the succeeding reverse twisting operation. When this yarn has been completed, it is taken and placed on another similar frame, and is then retwisted with two ends of 50-1.

THE RETWISTING,

or in other words the untwisting, of the first yarn loosens up the extra 30-1, and produces loops in an irregular fashion, where the extra yarn slips away from the ground yarn, and these loops are bound down firmly by the second twisting process. It is sometimes the case that the extra yarn in the first twisting process is delivered at one certain point on the ground yarn, thus creating a nub or bunch. This sort of yarn may or may not be retwisted, the method depending a good deal on the amount of twist imparted, and somewhat upon the use which is to be made of the product. Recently, we have noted yarns which were made in a method such as we have previously described, but which had in addition a nub effect used as a binder for the first process. Then there is the wide range of effects which are made through the introduction of either white or colored cotton stock, which yarns have been continuously used in certain classes of goods such as cotton flannels.

A different amount of twist in either twisting operation will affect the results and so will a change of yarn sizes or a relative change in the speed of the delivery rolls. In the retwisting process, the binding yarn is delivered about 10 per cent faster than the previously twisted yarn, this being done so as to produce the best effect, although with some yarns, the binder is delivered at the same speed as the previously twisted product.

YARN SIZE AND COST.

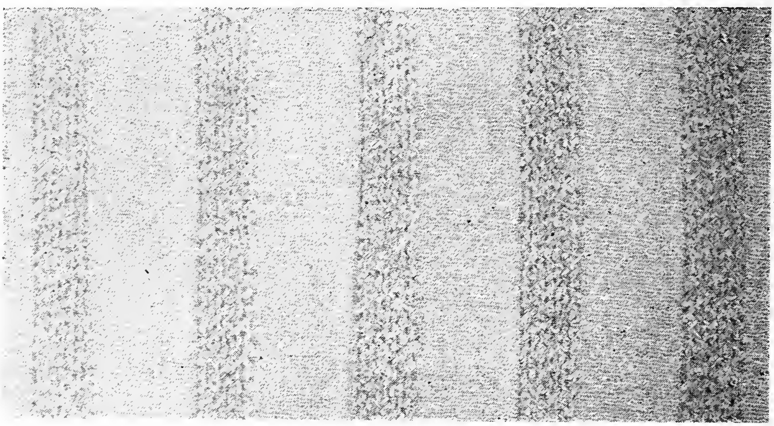
We have given in the fabric analysis certain facts regarding the yarn sizes and the cost of making. This is a feature which many have not considered in a correct manner, and needless to say, the results obtained are often very inaccurate. A good many have believed that the cost of making novelty yarns is very high, and this is true for certain varieties, not only because of their component parts, but also because of the difficulties caused by producing, but for most varieties, the cost is comparatively low.

In order to obtain anything like a correct cost, when the various yarn sizes are used, it is necessary to obtain the yarn analysis with the percentages of take-ups, or relative yarn sizes. To make the problem somewhat clearer, we have used a relative single yarn size where two ends of any yarn are used. With the take-ups in twisting, the relative yarn sizes are as follows: 25-1 for the ground yarn; 7.5-1 for the loop yarn, and 22.5-1 for the re-twist yarn. Using the ordinary method to obtain the resulting yarn size when three different sizes of yarns are twisted together, that is to divide the highest yarn size by itself, and the coarser sizes in succession, and then to add the results obtained. When this is completed, the highest yarn size is again divided by the result obtained, thus giving the completed yarn size.

In the yarn in the fabric under discussion, the size is approximately 4.6-1. Assuming that the cost of the single yarns in the mill is known accurately, it is a comparatively easy problem to obtain the cost for each size of yarn used in producing the novelty yarn results. Inasmuch as the novelty yarn, when completed, contains 3,864 yards per pound, this number of yards divided by the yards per pound in each yarn, and multiplied by the cost, will give the correct result. It will thus be seen that the various yarns used in making the novelty yarn cost 26.84 cents per pound. To this amount there must be added the various labor, expense and other items for the two twisting operations. In some cases, the labor cost is high, because a good deal of experimentation has to be made before satisfactory results are produced.

There has been a general tendency to place too high a cost on the making of such yarns, mainly because few took the trouble to investigate the various items which affect the cost, and high prices offered a protection against manufacturing losses. It must be remembered that the production on the twisters after the correct yarn effect is produced is quite large, due to the coarse yarn sizes. One item of importance when making novelty yarns, and one which is often neglected is that there should be a sufficient amount of strength to make the yarn usable. Most of the strain is noted on the ground yarns, and because the twisted yarn is so coarse in size, there is a tendency to expect it to stand a great deal of rough handling. This is not always possible, and many yarns have been produced in which the ground yarn would break and allow the novelty effect to disappear, making bad places in the cloth. Good yarn construction permits a greater production during the twisting process, and creates much less trouble in the weave room with a higher percentage of production and a smaller number of seconds.

In addition to having stripes made of novelty yarns, the fabric analyzed is woven with a crepe construction, the number of threads and picks per inch being very low, and the fabric will slip easily. In making such a construction, the filling yarn usually contains much more twist per inch than would ordinarily be the case. The hard twist in the yarn will make the cloth shrink up, when it is finished, thus giving the irregular or crepe effect. In this cloth, even the warp yarn has a somewhat greater twist than usual, and the cloth shrinks in length as well as in width, although this is not a customary method in domestic mills. The usual standard of twist for filling yarn is about three and three-quarters times the square root of the yarn size in turns per inch, although the amount is reduced to three or less, when mercerization is to take place, but for most hard twist filling, the standard is from seven to eight and one-half times the square root of the size in turns per inch, with probably seven and one-half used in the majority of instances.



The Novelty Crepe Analyzed.

Of course, there have been instances where a greater number of turns per inch than that indicated have been inserted, and in some cases fewer turns have been used. What this means for a yarn like that used in the cloth is shown as follows: The

square root of 50-1 is 7.07, and with a standard of $7\frac{1}{2}$ used, the turns per inch would be practically 53. Ordinary 50-1 yarn, with a standard of $4\frac{1}{2}$, contains only about 32 turns per inch, so that it will be readily recognized that the production per spindle is much less than it is for ordinary warp, with an increase in the various costs of producing. Many crepes are produced with filling twisted in one direction only, but the majority of the high class articles contain both regular and reverse twisted yarn.

In some fabrics one pick of one twist and then another pick of the reverse twist is inserted, while in others two picks of each are used in succession. The pulling of one twist against the other when the cloth is finished produces a regular crepy effect, while if one twist only be used the pulling is all in one direction and this produces a wavy effect, which does not look at all like the fabrics produced with two kinds of twist.

Naturally, to weave two twists of yarn a box loom is needed, and when only one pick of each twist is used a pick and pick loom is necessary. To allow sufficient time for the shuttles to be changed, the loom speed is somewhat slower than would otherwise be the case, possibly about 10 per cent slower being the rate on comparatively narrow goods.

Fabrics such as we have analyzed are likely to sell at very high retail prices not only because they are stylish, but also because the orders received are comparatively small and an exclusive price can be obtained. The general practice is to obtain the best price possible from buyers, and this policy results in high prices and profits when the demand is good. A comparatively small profit per yard will allow a good return to the mill, inasmuch as the production of the loom is comparatively large, due to the small number of picks per inch. Although many of these grey cloths cost comparatively little to produce, there are other features which make the cost to a converter a good deal higher. One of these is the cost of finishing and another is the fact that there is a shrinkage in the length of the cloth delivered instead of the stretch noted in a good many kinds of cloth. This shrinkage is not noted on many cloths but is evident on the one considered.

Then it is a fact that selling expenses are high through the cost of samples and the proportion which they form on the comparatively small orders. Often a large risk is taken when novelties are purchased, for should the style change the losses would be quite large. On the fabric analyzed it is undoubtedly true that a portion of the price is represented through duties which are necessary because of importation. There is, however, no real reason why many domestic mills could not produce this identical fabric so as to sell at retail at less than 50 cents per yard instead of the 90 cents per yard which is now noted, in fact they do sell many cloths which cost them far more to produce finished at prices which permit them to be retailed at less than 50 cents per yard.

The number of parties that handle the goods have a good deal to do with the prices which are noted, although the attitude which some sellers take in the distribution has an influence on the matter. Certain fancy cotton goods when sold to consumers are handled by three different people while other styles are handled by as many as five or six distributors with a corresponding increase in price, which often is not at all justifiable or necessary. We have seen identical fabrics selling at 50 cents and also at 75 cents per yard in different retail establishments, and it is often possible to see on the same counter fabrics selling at different prices, the low priced fabrics actually costing more to produce and containing more style than the high priced articles. This is not wholly caused by the ignorance of retailers on the subject of value, but is often brought about by excessive prices on the part of previous sellers and in some cases because of wrong estimates as to the cost of production. In a general way most of the fabrics are either sold in the white state or are piece dyed. Of course, when colored yarns are used in making the novelty yarn, it is

not necessary to bleach or dye the cloth and the effects are possibly more varied. The method of obtaining the yarn weights and yards per pound are no different than for an ordinary fabric. Some times when no details regarding the novelty yarn making are necessary, the novelty yarn is sized just the same as if it were a simple yarn and the result used in obtaining the weights. It is a

VERY GOOD PRACTICE

to obtain the size of the novelty yarn by weighing in order to check up accurately the figured size, such as we have obtained The take-ups on the fine yarns composing the crepe portion of the cloth are comparatively small and that of the novelty yarns practically negligible, excepting that there is a loss in the preceding operations. A portion of the take-up noted on the yarn is developed when the cloth is finished, but we have not considered such shrinkage, inasmuch as it does not affect the cost of the cloth in the grey state. When the converter has the cloth finished he can regulate his expenses per yard by the number of yards which he receives, so that there is no necessity for using such items in obtaining the mill cost. The method of obtaining the various weights is as follows, the novelty yarn being considered as a single yarn, although it contains six strands of single yarn:

1,762 ends ÷ (50/1 × 840) = .0420, weight of 50/1 warp without take-up. ....
6% take-up in weaving.
.0420 ÷ .94 = .0447, total weight of 50/1 warp per yard of woven cloth.
343 ends ÷ (46/1 × 840) = .0887, weight of novelty warp without take-up.
2% take-up, or loss.
.0887 ÷ .98 = .0905, total weight of novelty warp per yard of woven cloth.

$$\frac{48 \text{ picks per inch} \times 50'' \text{ reed width} \times 36''}{36''} =$$

2,400 yards of filling per yard of cloth.
2,400 ÷ (50/1 × 840) = .0571, weight of 50/1 filling per yard of cloth.
.0447 + .0905 + .0571 = .1923.
1.0000 ÷ .1923 = 5.20 yards per pound (grey).

NOVELTY YARN STRIPE CREPE.

PATTERN.

50/1 Am. combed warp	$\frac{2}{24}$	16	18	$\frac{2}{24}$	=	1,762
4.60 novelty warp		7			=	343
		$\underbrace{\qquad}_{49\times}$				2,105 total ends

50/1 Am. combed filling, hard twist, 48 picks.
24 reed, 50" reed width, 42" finished width, 47" grey width.
Finished count, 50 × 50.

YARNS.

	Cotton.	Labor, waste, etc.	
50/1 Am. combed warp; 1 5-16" staple, 10 hank dou. rov.,	21c.	16½c.	= 37½c.
30/1 Am. carded warp; 1⅙" staple, 6 hank dou. rov.,	13½c.	6½c.	= 20c.
50/1 Am. combed filling, H. T.; 1¼" sta., 12 hank dou. rov.,	19½c.	24½c.	= 44c.

NOVELTY YARN.

2 ends 50/1 ground threads = 25/1 comparative size.
2 ends 30/1 loose yarn = 15/1 comparative size.
2 ends 50/1 retwist = 25/1 comparative size.

25/1 ÷ 25/1 = 1.0000
(15/1 + 100% take-up = 7.5/1)
25/1 ÷ 7.5/1 = 3.3333
(25/1 + 10% take-up = 22.5/1)
25/1 ÷ 22.5/1 = 1.1111

5.4444

25/1 ÷ 5.4444 = 4.60 novelty yarn figured size (approximately).
Yards per pound in novelty yarn, 3,864.

$$\frac{3{,}864 \times 37\tfrac{1}{2}\text{c.}}{25/1 \times 840} = .0690$$

$$\frac{3{,}864 \times 20\text{c.}}{7.5/1 \times 840} = .1227$$

$$\frac{3{,}864 \times 37\tfrac{1}{2}\text{c.}}{22.5/1 \times 840} = .0767$$

$.2684, total cost of yarns used for making 1 lb. of novelty yarn.
$.2684 + 8c. (2 twisting operations) = 34⅞c., total cost of novelty yarn per pound.

CLOTH COST.

1,762 ends 50/1 Am. combed warp + 6% take-up	= .0447	@ 37½c. =	$ .0168
343 ends 4.60 novelty + 2% take-up	= .0905	@ 34⅞c. =	.0316
48 picks 50/1 Am. combed filling hard twist	= .0571	@ 44c. =	.0252
Weaving			.0283
Expenses			.0123
			$ .1142
Selling (grey)			.0023
Net mill cost (grey)			$ .1165

Finishing charges, about 4c. per yard.
Retail price, 90c. per yard.
Yards per pound, 5.20 (grey).

FANCY PILE FABRICS

Probably the one fabric which has created the greatest amount of interest among buyers of cotton goods is the fabric which is variously known as toweling, eponge, ratiné and other names which designate the same fabric. To anyone acquainted with manufacturing, the above-mentioned names mean a special cloth, although retailers and others have not been accustomed to distinguish between them.

An eponge, as the term is generally understood, is not the same fabric as a toweling or terry cloth, and a ratiné is different from either. One of these fabrics is made by a finishing process, another is made through the use of novelty yarns, while the other is made by a loom mechanism. All of these fabrics have been used for a wide variety of purposes, such as dresses, trimmings, hats, vests and other purposes, and inasmuch as they have sold largely, and are somewhat different in construction than fabrics formerly produced, it may be well to consider two fabrics which are made with ordinary yarns, but which are manufactured by a loom mechanism rather than through any other process.

TOWELING OR TERRY CLOTH.

These fabrics may be called toweling fabrics or terry cloths. Many of the ideas which have been developed for sale at present have been concocted from ordinary toweling constructions, and inasmuch as they are special fabrics and because they have been stylish it has been possible for manufacturers and sellers to be particularly successful in their making.

We have at intervals presented a number of analyses of fabrics which would be included under this general heading giving the sizes of yarns and the methods of production, together with the selling prices and probable profit. When many of these cloths were first produced they were not very satisfactory, but inasmuch as any special ideas are developed gradually and are not produced when the notion is first in demand, the same condition is noted in the production of fabrics such as that considered. It might be said that there are two definite methods of producing terry cloths, one in which there are two warps used and in which the weave together with the loom mechanism allows a certain amount of extra yarn to be forced into the cloth, thereby producing a rough appearance on either or on both sides of the cloth.

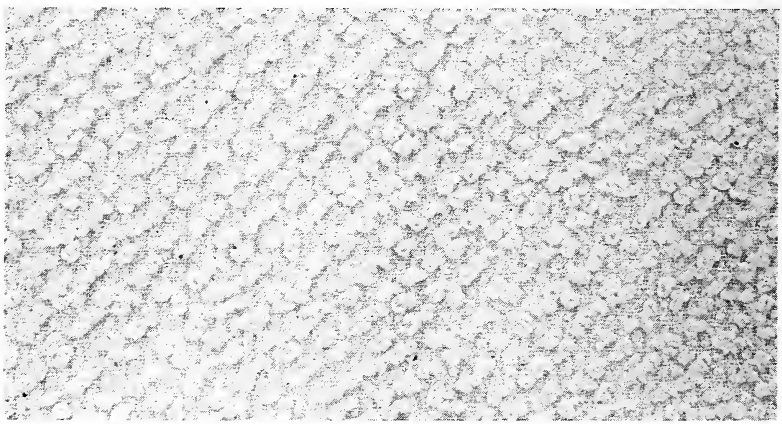
These terry cloths are produced by different methods on the loom, but the general result, so far as the cloth is concerned, is practically the same. The second method is one in which a different mechanism is used, and in which wires are inserted to make the loops as the cloth is being woven. Certain styles of fabric which are impossible of production by the first or terry motion are easily produced through the second method, although of course, there are sometimes very good imitations of the second kind of cloths made. The wires which are used are inserted and withdrawn as the cloth is being woven, and because

of such facts the loom speed is low, and the cloth production is not so high as the number of picks which the loom makes would indicate.

Various dobby and jacquard patterns are produced by both methods. The limitations forced by the first method of manufacturing are ones which arise from the fact that all of the loop threads are placed on one or at least only a few beams, therefore allowing only one or two different effects to be produced, while through the second method there may be a different take-up on the various threads forming the loops much the same as there is on certain styles of carpets.

We are presenting two styles of fabric which are manufactured by the second method, namely through the use of wires. An examination of the weave of one of the cloths will indicate quite clearly how the use of wires is distinguished. Taking the loop threads which are marked at the top of the weave with black places it will be noted that where the wires are inserted (the places at the right where black marks are made indicating such insertion) it will be seen that unless a wire was inserted to hold up the loop it would weave no differently than in the other places of the design, because the loop threads are down or on the back of the cloth both before and after the wire is inserted.

In the first fabric considered the result produced is quite novel, although it is entirely probable that the sale of both of these materials considered is rather limited. It will be seen that the loops are not placed in a regular manner, as is noted on the stripe cloth, but that they are placed at intervals with quite a little of the ground cloth showing. The method of placing the loops on the cloth, or weave, if it might be called such, is a four-harness one, with the loop yarn having four different positions anu being raised for one wire pick and then depressed for the three following similar picks.



The Novelty Toweling Fabric Analyzed.

The weave is the one which many have been accustomed to call a four-harness satin, although, strictly speaking, there is no such weave as a four-harness satin. The warp threads which form the ground cloth all weave plain, as may be noted by examining threads number one, two, three, six, seven, eight, etc. The places where such threads do not appear to weave plain on the design as laid out are caused by the insertion of the wires which form the

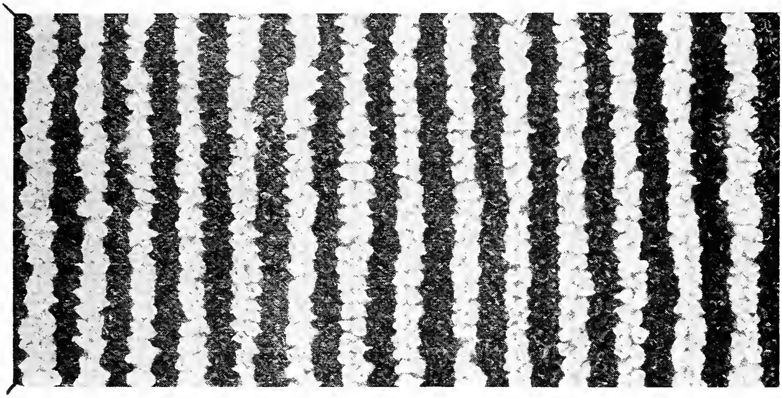
loops and have nothing at all to do with the weave of the ground threads. It will also be noted that there is no break in the plain weave on the ground threads from one loop to the next loop in the warp direction.

It may be well to mention the fact that many of these novelty toweling fabrics are made with a much better construction than they were when the demand first began to be noted for such styles. Many of the cloths produced at that time had a comparatively loose construction and were hardly suitable for dress materials although many of them were used for such purposes. Gradually as the need became more recognized the construction of such fabrics was adapted so as to be more nearly what they are to-day and more satisfactory and with a greater amount of serviceability.

We have given an analysis of this previously described cloth with an approximate cost of production. One of the facts regarding this fabric and one which should be responsible for a great deal of service in comparison with many of such lines is that the yarns used in its making are all two-ply. It may be possible that instead of a 30-reed as we have used a 15-reed was used with twice as many threads per dent. The various details regarding the yarns and their making is what would be noted in the domestic market and in a good sized, well-managed plant.

The cost of the cloth will depend a good deal upon various circumstances. This material was undoubtedly imported, and under such circumstances the yarns were probably made in one plant and the cloth woven in another, and to the costs of the yarn, as noted, there would have to be added a certain amount of yarn profit, depending upon general market conditions. It is, however, likely that the costs named represent very closely the selling prices which would have been noted were such yarns purchased in foreign countries. There are comparatively few fabrics of this nature produced in the domestic market, and, due to the difficulties of manufacturing, the costs of weaving and expenses per yard are much higher than they are on a great many other varieties of all-cotton cloth.

This fabric can be made in the grey state and then dyed in the piece after it is woven. We have not attempted to give the various items of cost after the grey cloth was woven, but it undoubtedly was handled by a number of various sellers, and a portion of the price is represented by the duties which are assessed. One



Black and White Striped Novelty Made of Single Yarns.

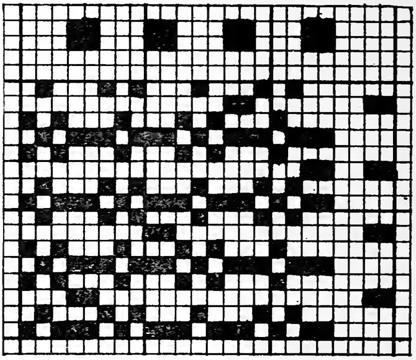
thing which limits the use of many of these fabrics is the fact that they are so much heavier than consumers have been accustomed to use for summer wear, thus limiting the season in which they can be satisfactorily worn. There have been, however, many more of such goods sold than ever before, and the development of the idea has been responsible for many striking novelties, and, without doubt, some of these cloths will be sold continually as dress goods.

Possibly, the fabric which is of greatest interest, although it is not nearly as complicated in weave, is the black and white striped material. This fabric is made from dyed and bleached yarns, and probably costs more to produce than the one for which the cost has been given. There have been used in this fabric certain methods which are responsible for certain effects, and the results are ones not often noted. Naturally, the method of dressing the warp is responsible for the production of the stripes in the cloth. The warp in this fabric is dressed much the same as it is in the fabric previously described, excepting for the introduction of color, that is, there are three ground threads and then two threads of loop yarn drawn in regularly throughout the whole fabric.

It may be well to note, however, that this cloth is made from single instead of two-ply yarns, with the exception of the loop yarn which is two-ply in a large majority of such fabrics. One feature which is of interest in this cloth is the looseness of the twist in the yarn which forms the loop. Many fabrics of this character have loosely twisted loop yarns, but there are very few of them which have the same result that is noted in the fabric under discussion.

A careful examination of the black yarn will show that it has been mercerized and then dyed, but that the dyestuff or the dyeing process which has been used does not penetrate to the centre of this two-ply mercerized yarn. When the fabric is examined there is a certain peculiar effect noted from the fact that the yarn is not thoroughly dyed, making a contrast with the black dyed fibres, ensuring an appearance of much more luster than actually exists.

This result occurs because the mercerized yarn bends sharply when it forms the loops, opening up the twist and showing the white fibres at the top of the loop. Possibly, this result was not intentional, but nevertheless, the effect which it produces is seldom noted and is worthy of mention. If it was intended to produce this result, a great amount of ingenuity has been used in developing it. Few would consider that the result noted would be produced through the dyeing of the yarn, but this appears to be the case.



Weaving Diagram.

We have given for this black and white fabric the analysis with the weights of the various yarns which are used in its production.

In an anaylsis of a fabric such as that described, the item of importance is the take-up on the warp yarns. It will be noted in the fabric for which the cost has been given that the take-up was 46 per cent, or, in other words, it took about two yards of loop yarn to weave one yard of cloth. On the striped fabric the take-up is quite a little greater, because of the fact that the loop is made continuously, while in the first fabric it was not. In this cloth the take-up was 69 per cent, thus making ten yards of yarn necessary in weaving approximately three yards of cloth. It will also be noted

that the take-up on the fine warp used for the ground cloth is somewhat greater than it would be were an ordinary fabric produced. This is noted because of the use of the heavy yarn for loops and the weave which the cloth contains. The yarns which are used in producing such fabrics are not any different than those used in making ordinary fabrics, for they are regularly made, although the two-ply yarn used in the loops is usually soft or comparatively soft twisted. Both of these cloths sell at retail for $2 per yard, and quite a little has been sold.

The weave in the striped fabric on the loop yarn is one up and two down, although this does not appear to be the case until the threads are pulled out and it is considered that a wire had been woven in the cloth and then withdrawn. These fabrics are very interesting, inasmuch as they represent the development of an idea for dress fabrics which was formerly considered rather undesirable. That there should be variations in weave and an improvement in construction is only natural, and the fabrics which we present include both ideas.

FANCY PILE FABRICS—BLUE CLOTH.

PATTERN.

80/2 Am. combed warp $\frac{2}{48}$ 3 $\frac{2}{48}$ = 2,244

20/2 Am. carded warp $\underbrace{\quad 2 \quad}_{684\times}$ = 1,378

3,622 total ends.

60/2 Am. combed filling; 52 picks (not including wires).
30 reed; 47" width in reed; 42⅜" width finished.
85 × 52 over all count finished.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
80/2 Am. combed warp; 1 7-16" sta; 16 hank dou. rov.,	25c.	28½c.	5½c.	= 59c.
20/2 Am. carded warp; 1⅙" sta; 4 hank dou. rov.,	13½c.	4½c.	⅞c.	= 18⅞c.
60/2 Am. combed filling; 1 5-16" sta; 12 hank dou. rov.,	21c.	19¼c.	3½c.	= 43¾c.

COST.

2,244 ends 80/2 Am. combed warp + 11% take-up ....=.0751 @ 59c. =	$ .0443
1,378 ends 20/2 Am. combed warp + 46% take-up ....=.3037 @ 18⅞c. =	.0573
52 picks 60/2 Am. combed filling ....=.0970 @ 43¾c. =	.0425
Weaving	.0597
Expenses	.0324
	$ .2362
Selling (grey)	.0075
Mill cost (grey)	$ .2437

Yards per pound 2.10 (grey).
Cost at retail $2 per yard.

STRIPED CLOTH.

PATTERN.

35/1 Am. carded white $\frac{2}{24}$ 3 3 3 3 3 $\frac{2}{24}$ = 2,151

24/2 Am. combed mercerized black 2 2 2 2 = 688

24/2 Am. combed white 2 2 = 684

$\underbrace{\qquad}_{171\times}$ 3,523

30/1 Am. carded white; 44 picks.

2,151 ends ÷ (840 × 35/1) = .0732, white single warp weight without take-up.
12% take-up in weaving.

.0732 ÷ .88 = .0832, total weight of white single warp per yard of cloth.

1,372 ends ÷ (840 × 24/2) = .1361, weight of two-ply warp without take-up.
69% take-up in weaving.

.1361 ÷ .31 = .4390, total weight of ply warp per yard of cloth.

$\frac{\text{44 picks} \times 45\frac{1}{2}\text{" reed width} \times 36\text{"}}{36\text{"}}$ = 2,002 yards of filling per yard of cloth.

2,002 ÷ (840 × 30/1) = .0794, total weight of filling per yard of cloth.
.0832 + .4390 + .0794 = .6016, total weight per yard.
1.0000 ÷ .6016 = 1.66 yards per pound.

BUYERS' COST KEY

Some time ago we presented a method whereby the cost of grey cloths could be accurately obtained by a buyer, although the various ideas which were employed were also of value to a manufacturer in that many of such do not observe any great accuracy in the systems which they employ, and the results obtained are sometimes not founded upon the basic facts of cloth construction. For various reasons the method adopted was not the one which would be most desirable from a manufacturer's standpoint, although probably the main reason why such systems would not be identical is the lack of technical knowledge on the part of the buyer. Usually a purchaser can obtain the number of threads and picks per inch in any cloth very easily.

It is also possible for him to obtain the weight per yard and the width of the cloth. Of course, buyers often have more information than the above regarding the cloths which they are handling, but there should be no great difficulty for any one of them to obtain these details at least. As stated when we presented our grey cloth cost method, the fundamental facts were first, that there are 840 yards per pound to No. 1 yarn, 1,680 yards per pound to No. 2 yarn, or 40 times 840 yards or 33,600 yards per pound in No. 40 yarn, and second, that in a pound as used for weighing cotton yarn there are 16 ounces or 7,000 grains.

PROBLEM NOT DIFFICULT.

To anyone who is familiar with cloth analysis the problem is not at all difficult, inasmuch as the weights of the various yarns used can be obtained, but for a buyer the simplest method is that wherein the average yarn size is obtained for the cloth as it is sold. So far as this portion of the method is concerned, it is identical with that employed when grey cloths are being treated. An illustration may, however, be of service in making the various details evident. A certain colored fabric contains 86 threads and 81 picks per inch. It is 31¼ inches wide and weighs 7.70 yards per pound. The number of threads and picks per inch added together and then multiplied by the cloth width will produce the number of yards of yarn used in making one yard of cloth without considering the amount of take-up. This result multiplied by the number of yards per pound will furnish the number of yards of yarn per pound, and through the addition of the take-up the total yards per pound can be obtained.

When any number of yards of cotton yarn weigh one pound the size can be secured by dividing the number of yards by the recognized standard for No. 1 yarn. The details for the cloth given are as follows:

86 threads + 81 picks = 167, total threads per inch.
167 × 31¼ cloth width = 5,219 yards of yarn per yard of cloth without take-up.
5,219 × 7.70 yards per lb. = 40,186 yards of yarn without take-up.
Using 10% take-up in weaving, we get
40,186 ÷ .90 = 44,652, total yards of yarn per pound.
44,652 ÷ 840 (standard) = 53, average yarn size.

PICKS PER INCH.

There should be no great difficulty in obtaining the number of threads and picks per inch. For a fabric which is entirely plain weave a comparatively simple count will answer the purpose. For stripes, checks, or where any other kind of a pattern is employed, it is a very good plan to count the total number of threads or picks in a pattern repeat and the space which they occupy in the cloth, thereby obtaining the average number per inch. The take-up on different fabrics will vary quite widely, due to the cloth construction, yarn sizes and number of picks per inch, but the 10 per cent which we have used may be considered a fair average. Should more accurate results be desired, it is possible to pull out a number of threads and picks, ascertaining the amount which they stretch, and thereby obtaining more accurately the yards of yarn per pound. For yarn dyed fabrics, however, on an ordinary good construction, the large majority of results will be satisfactory when a take-up

of 10 per cent is used. Upon this average number is based the cost of the material which enters into the cloth as made.

This yarn cost for convenience has been made to cover all the various items which ordinarily affect the cost of production, but it is admitted that there are many cases which must be treated in an individual manner if anything like accurate results are to be secured. There are a few features which tend to make the cost of colored yarn goods lower than for grey yarn fabrics, while there are many more details which tend to increase their cost, so that in the majority of instances colored goods are relatively more expensive than grey cloths. Up to the time the yarn is placed on beams in the grey state very little difference is noted, but additional processes which are rather expensive increase the cost of dyed yarns, so that when they arrive at the loom their cost is appreciably higher than for grey yarns.

EXTRA PROCESSES.

Some of the extra processes which increase the cost are ball warping, doubling, bleaching, dyeing, sizing, separating, beaming, slashing and quilling. In many instances the processes are even more numerous, especially where certain results are to be secured. It often happens that a process is used which, while adding to the previous cost, makes it possible for large enough economies to be effected in the succeeding operation to make its adoption worth while. In addition to the labor and other expense items there are certain losses in yarn which sometimes radically increase the cost and which are not often noted when grey goods are made. Some of the facts which are well to bear in mind when colored goods are being considered are that, due to excessive handling, the yarn sizes are usually coarser than are noted in many grades of grey material. It is seldom that colored yarns are used much finer than 60s-1, and when finer yarns are handled they are likely to be ply rather than single. It is probable that the large proportion of colored cloths are made from yarns of 30s-1 or less in size.

It is seldom that a much finer warp than filling is used, inasmuch as the warp is handled extensively, and the coarser the size the less the cost of handling is likely to be. This is not noted in the making of grey goods, for many of the large selling ordinary fabrics contain a warp which is much finer than the filling. In any case, there are not the serious objections to the use of fine warp which are noted when colored goods are being made. Filling for colored fabrics is handled much more than it is for grey goods, and for this reason a much higher standard of twist is employed, so as to give sufficient strength, though this results in a harsher cloth than the same size of grey yarns is likely to produce.

COLORED FILLING YARN.

Colored filling yarn is handled in much the same manner as warp with the exception of the beaming and slashing operations, where a quilling process is substituted. Comparatively few combed colored yarns are used, mainly because most of the yarn sizes are so low as to make this process unnecessary. In some instances combing is used when fine ply yarns are being made or where a special fabric is being produced, and it is sometimes necessary when fast or dark colors are being used. The fibres on a black or dark dyed yarn are likely to be very noticeable when used alongside a bleached stripe, and inasmuch as the combing process eliminates a large proportion of the short cotton fibres and makes a smoother yarn, it is more successful to use combed yarn in these instances even if the cost is higher and combing unnecessary, so far as practical yarn making or handling is considered.

One item of importance, and which has much to do with successful manufacturing is the correct balance between the cotton staple used and the size of yarn produced. With many grey yarns the cost of cotton is a large item, and while it also is of much importance in colored work,

the additional processes make it of less importance, that is, it is often possible to use a better cotton and save enough through such use to make it worth while, whereas it would be an undesirable policy and would increase the cost on grey goods. For the above reason, most mills making dyed yarn fabrics are likely to use a better cotton for the same size of yarn than grey cloth mills, this being especially true when numbers higher than 30 or 35 are being made, or where quality is of importance. Many grey cloth mills are so arranged that a great variety of yarns, both as to size and quality, can be produced, and the same is true regarding the kind of cloth produced from these yarns, but mills making dyed yarn fabrics use combinations of color and other similar features to produce their styles, and the yarn sizes and cloth constructions do not change radically from year to year, neither is there any great variety in the sizes of yarns being produced.

ECONOMICAL YARN MAKING.

This offers an opportunity to practice economy in yarn making, and were such a condition possible in some of the fancy grey cloth mills, the present cost of production could undoubtedly be further reduced. Many yarns which are dyed have to be given a bleaching process previous to the dyeing operation, while others are only partially bleached, and there are quite a good many on which dark colors are used that are not bleached at all. These varying conditions naturally affect the cost, and unless care is exercised incorrect results are very liable to be obtained.

Naturally, the best way is to treat each cloth separately, but a buyer is not acquainted at all with processes and cannot adopt such a method. Neither is there any great necessity for any such accuracy so far as he is concerned, inasmuch as it is necessary for him to pay the quoted prices, and an estimated cost may be considered only as a protection against excessive profits. Colored goods are not sold by the same method as grey goods, and mills while competing for business are not running on identical constructions, and a certain amount of leeway is therefore offered them.

Possibly, the problem which would be most difficult for a buyer to solve is the condition which develops when a portion of a colored fabric is made of white or bleached yarns. A cloth which is made of certain yarn sizes will not cost so much when a large proportion is white as it will when most of it is colored. This is because the dyeing operation is a separate process from bleaching, and there are various labor and expense items which add to the cost, and, in addition, there are the varying increases necessary through the dyestuffs used. The various colors cost different amounts, depending on the depth of shade, the fastness to light, washing or bleaching, and other general characteristics, but when the other expenses are added, the variation in cost for all the processes is not so great as might be expected.

ORDINARY COLORS.

Of course, this refers to normal yarns and ordinary colors and does not have any relation to some of the low-grade results often produced, neither does it apply to special yarns which have to be handled extensively with a resulting high cost. Naturally it does not refer to stock-dyed yarns on which the cost of production is much lower, although the results produced are many times as good or better than when yarns are dyed.

One fact which should be mentioned is that the total cost of dyeing and handling yarns does not increase in the same manner as does that for producing grey yarns. It costs just about twice as much for the various labor and expense items on 32s-1 grey yarn as it does for 20s-1 grey yarn, but it is not true that the costs of bleaching and dyeing are twice as much for 32s-1 as they are for the same kind of 20s-1 dyed yarn. It does cost more per pound to dye, bleach and handle a fine than it does a coarse yarn, but the advance in price does not bear the

same relative proportion to the advance on grey yarns.

The costs of the various processes when converting grey yarns into bleached or dyed yarns will vary widely, due to manufacturing conditions, that is, when a small amount of any color is handled the items which go to make up the cost will be high, but where large quantities of a comparatively few colors are being made quite large reductions will be noted. For this reason, there will be a greater variation from any normal standard when dyed fabrics are being considered than when other varieties of cloth are being made, and it is less possible to obtain a correct cost unless each fabric is considered on an entirely different basis, and, therefore, impossible of accomplishment for a buyer. The items which are more or less staple do, however, make it possible to obtain a general idea regarding the costs of making. Realizing that there are very many cases where the methods we have used cannot apply, we are presenting a table for yarns containing the total cost of the various processes. This is for carded yarns, inasmuch as they are more frequently used than combed:

Yarn size.	Total yarn Cost dyed.
10	22.43
12	22.92
14	23.43
16	23.96
18	24.49
20	25.02
22	25.69
24	26.30
26	29.27
28	29.96
30	30.67
32	31.40
34	32.52
36	35.07
38	35.83
40	36.55
42	37.32
44	38.15
46	41.18
48	42.02
50	42.85
55	44.90
60	49.08

SIZE OF YARNS.

Previously we explained how the average size of yarns in any colored fabric could be obtained. At the same time, it is easy enough to obtain the yards per pound by an ordinary weighing process. If there are 7.00 yards per pound, and the average yarn size is 44s-1, the result will be obtained as follows when the yarns used are all of a dyed character. For 44s-1 average size the total cost from the table is 38.15 cents per pound, and with seven yards per pound the cost per yard for material would be 5.45 cents. Not all colored yarn fabrics are, however, of solid dyed yarn, in fact the majority contain a greater or less proportion of bleached material, and this complicates the process to a certain extent. For ordinary purposes an approximate result can be secured as follows:

In a dyed yarn fabric, when the number of threads and picks per inch are being secured it can be ascertained how many of these threads are dyed and how many of them are bleached. For illustration, in a cloth containing 80 threads per inch, 36 of them are dyed, while of the filling 24 out of the 56 used are dyed. This gives 60 dyed threads out of a total of 136. Bleached yarn costs approximately 4 cents per pound less than dyed yarn, so with 44s-1 there would be 60-136 of the total weight at 38.15 cents per pound and 76-136 at 34.15 cents per pound, or 16.88 cents for dyed yarn and 19.08 cents for bleached yarn per pound, and with 7.65 yards per pound the results per yard would be 2.21 cents for dyed and 2.49 cents per yard for bleached yarn. A similar process can be observed where fancy patterns, stripes or checks are employed, and while the variation in yarn size between warp and filling and the fact that different depths of color and other features affect the results, the inaccuracy will be comparatively small, due to the other items of cost.

WEAVING COSTS.

In regard to the weaving costs and the various other expenses which occur after the yarn has been prepared in a manner suitable for use in the weave room it can be said that there are many items which are likely to affect the results. For ordinary fabrics the actual loom production in

yards per day or yards per week is probably the most reliable ratio to consider when obtaining the cost of production which follows the cost of yarn making. There are many fabrics which through special weaves or complicated conditions of manufacture cannot be considered on the basis which we are using. Many colored fabrics are to-day being produced on automatic looms with many more looms per weaver and with a reduction in the cost of production, but the use of automatic looms is by no means as common as it is on certain kinds of grey goods, and for this reason, cannot be considered when the majority of fabrics are being analyzed.

Automatic looms do make economies possible, but up to the present time these savings have been secured largely by the manufacturer, and there has been no great tendency to force prices onto an automatic loom basis, a condition which is slowly but surely developing in the grey goods market, and which is making it less possible to secure any very large dividends when ordinary looms are being used. Loom production will vary according to the speed and percentage of production, and will affect the cloth cost accordingly. A box loom which is producing any kind of check patterns will operate slower than one making stripes or ordinary patterns, but for ordinary fabrics of medium width a reasonable degree of accuracy can be secured. In addition to the labor cost of weaving and handling, there are various other expenses to be considered, such as insurance, repairs, depreciation, power, light, shipping charges and various other details, also the cost of selling the merchandise.

We have included all these various items under one classification, and while there are certain instances where such a classification is objectionable, there are reasons why the

SIMPLEST METHOD

is desirable, and there should be no great difficulty in ascertaining the correct amount for any fabric which is being considered. The various amounts for each fabric are designated by the picks per inch which the cloth contains, and it is a total cost.

Picks per in.	Total Costs. Cents per yd.	Picks per in.	Total Costs. Cents per yd.
30	1.22	66	3.02
32	1.32	68	3.12
34	1.42	70	3.22
36	1.52	72	3.32
38	1.62	74	3.42
40	1.72	76	3.52
42	1.82	78	3.62
44	1.92	80	3.72
46	2.02	82	3.82
48	2.12	84	3.92
50	2.22	86	4.02
52	2.32	88	4.12
54	2.42	90	4.22
56	2.52	92	4.32
58	2.62	94	4.42
60	2.72	96	4.52
62	2.82	98	4.62
64	2.92	100	4.72

Possibly, a number of illustrations will make the whole method of application very clear to those who are unfamiliar with the subject. A gingham fabric contains 82 threads in the warp and 84 picks in the filling. It contains 6.25 yards per pound, is 32 inches wide and is made from carded stock. (It must be remembered that the various details we have given are all for carded yarn.)

82 threads + 84 picks = 166, total threads per inch.
166 × 32" wide = 5,312 yards of yarn per yard of cloth without take-up.
10% take-up in weaving.
5,312 ÷ .90 = 5,902, total yards of yarn per yard of cloth.
5,902 × 6.25 yds per pound = 36,888 yards of yarn per pound.
36,888 ÷ 840 (standard) = 44/1 average yarn size.
The cloth is one-half dyed and one-half bleached yarn.
44/1 dyed = 38.15 cents per pound (from table).
44/1 bleached = 34.15 cents per pound. (4 cents less per pound than dyed).
19.08 (½ of 38.15 cents) ÷ 6.25 = 3.06 cents, dyed yarn.
17.08 (½ of 34.15 cents) ÷ 6.25 = 2.74 cents, bleached yarn.
Weaving and all expenses (84 picks in table) = 3.92 cents.
Total cost, 9.72 cents per yard.

Another illustration of a cheaper fabric may be of more service, inasmuch as it is more nearly what the majority of fabrics made from dyed yarns are likely to be. This has a count of 67 threads and 56 picks per inch, it is 27 inches wide and contains 6.40 yards per pound.

67 threads + 56 picks = 123 total threads per inch.
123 × 27" wide = 3,321 yards of yarn per yard of cloth without take-up.
10% take-up in weaving.
3,321 ÷ .90 = 3,690 yards of yarn per yard of cloth.
3,690 × 6.40 = 23,616 yards of yarn per pound.
23,616 ÷ 840 (standard) = 28/1 average yarn size.
One-half bleached and one-half dyed yarn in the fabric.
20/1 dyed = 29.96 cents per pound (from table).
28/1 bleached = 25.96 cents (4 cents less per pound for bleached).
14.98 (½ of 29.96 cents) ÷ 6.40 = 2.34 cents, dyed yarn.
12.98 (½ of 25.96 cents) ÷ 6.40 = 2.03 cents, bleached yarn.
Weaving and all other expenses (56 picks from table) = 2.52 cents.
Total cost per yard of cloth = 6.89 cents.

DOES NOT HOLD FOR ALL.

One of the conditions which must be very clearly understood regarding this method of obtaining the cost of cloth is that it does not apply at all to fabrics which are made from stock-dyed yarns, neither does it apply where yarns are dyed in any other manner than the ordinary processes of yarn dyeing. Neither does the method give accurate results when automatic or semi-automatic looms are being used. Such conditions of cloth making have to be treated on an entirely different basis, inasmuch as they are responsible for a different cost of production. Many styles of ginghams and similar fabrics are now being produced from stock-dyed yarns, and on automatic looms, and to these cloths this method does not apply. In most cases, it will be found that results are more satisfactory and more accurate for the ordinary lines of colored dress goods woven on ordinary looms than they are for some of the older types of fabrics upon which new methods have been adopted.

COTTON CLOTH COST FINDING.

A Key for Cloth Buyers and Cloth Makers.

The American cotton cloth industry has developed rapidly during the past few years, but just how fast few really realize unless they have been in close touch with selling conditions. Formerly, most of the fabrics produced were made from coarse yarns. and the patterns were made largely by the introduction of colors, while to-day the styling and weaves are of great variety, with yarns of much finer sizes and very much better quality. Naturally, such a development has been brought about through the demand of consumers, but along with this increased demand there have arisen many problems of selling and making which at one time were not of great importance.

In the first place many of the new lines of cloth are handled by converters or converting jobbers who place orders for fabrics and who designate what the cloth constructions and patterns are to be, and in this way the manufacturer is more a cloth maker than he is a cloth or style developer. In a large number of cases, this converter asks a mill treasurer to quote a price on the fabrics or combinations which he desires and which the mill has not previously made, and, therefore, a manufacturer must have some means of knowing fairly accurately the cost of making any cloth his mill is able to produce. This necessity has resulted in the keeping of careful records and from such records economical cloth making has partly been due.

The building of large mills. together with the great increase in competition, has also been responsible for the lowering of costs of production, as has the greater general knowledge regarding the fine points in fabric making. Under such conditions as have developed, even the older mills, which make fabrics of bleached and colored yarns, have found that a better knowledge than formerly is necessary regarding the costs of cloth making, that is if they continue in the race with others, and if the fabrics they produce be the ones which show the best margins of profit.

The cost systems which have been developed are, many of them, fairly satisfactory in the plant where they are used but are of comparatively

little value to others, and it can be said that there is about as great variety in the methods which are employed as could well be imagined. Admitting that these methods of finding costs are satisfactory to the mills using them, it will be seen that they give more or less protection to the cloth maker in that he can quote a price to a buyer which may or may not be exhorbitant. The buyer has no protection at all excepting that obtained through asking quotations from different sellers for the same cloth, and through his own judgment regarding the price at which the cloth will sell.

Because certain trained cloth makers have information of the above nature they are of value to cloth buyers, making money for them by saving it. Recognizing that a cloth buyer is just as important in distributing as a manufacturer is in producing, and knowing that absolutely no reliable information is obtainable on the subject, we are presenting a few general rules which will be of great value to buyers, and which will give a certain amount of aid to manufacturers.

FABRIC ANALYSIS.

It should be readily seen by anyone who understands anything about cloth that any reliable cost system must be based first on certain fundamental facts of cloth construction. In this it is no different than any other problem of construction, for the items material, labor, insurance, supplies and all the other details must be considered carefully. To many the problem appears very complicated, because the items for cotton cloth are so small per yard.

A cost estimate is either made from a stated construction or from a sample submitted, and as making a cloth analysis consists in obtaining the cloth construction, the problems are identical when this has been accomplished. There are two facts upon which cotton cloth construction depends, first, that No. 1 yarn contains 840 yards per pound, No. 2 yarn contains 1,680 yards per pound, and so on, or, in other words, that No. 50 yarn contains 50 times 840 yards, or 42,000 yards per pound, and second, that a pound, as used for yarn, contains 16 ounces or 7,000 grains.

In giving all of our estimates we have attempted to make the problem as simple as possible, not only regarding the yarns and their cost but also regarding the cloth and its cost of making. We have, therefore, laid out the cost on an average number basis, and while this has its defects, it gives results which are fairly accurate, and which are much more reliable than some mills have been in the habit of obtaining. The results are ones which might be noted in any medium-sized, economical plant, and while some operate at a lower cost, there are others which have a higher cost, and, in this connection, the figures given will be of value. Under certain conditions, some cloth buyers or cloth makers may desire to understand the method of analyzing a piece of cloth, and we, therefore present such a process.

ANALYZING CLOTH.

The first step in making a cloth analysis is to obtain the number of threads and picks per inch, and this is accomplished either by cutting out a certain amount of cloth with a die and then pulling out the threads and counting them, or else by counting the threads with a magnifying glass as they stand in the cloth. The threads per inch in the cloth multiplied by the cloth width will give the number of threads in the warp unless there be a special pattern where extra threads are used. This is, of course, not considering the selvages, for they are usually about a quarter of an inch wide on each edge of the cloth, and contain about twice as many threads as the ground work of the fabric.

The next step is to obtain the yarn sizes in the cloth being considered. This is done by pulling out threads and then weighing on accurate balances. The amount of yarn to be weighed will depend somewhat on circumstances, but any amount over

100 inches will give satisfactory results if the balances be accurate, although, of course, it is often possible to obtain only a few inches of cloth, and estimates must be made under such conditions. To illustrate the method used in finding the size of yarn an example may be of service.

AN EXAMPLE.

If 124 inches of yarn be pulled out and then weighed and the weight is 1 1-10 grains, what is the yarn size? The formula is.

$$\frac{124 \text{ inches} \times 7{,}000 \text{ grains}}{1.1 \text{ grains} \times 36 \text{ inches} \times 840 \text{ standard}} = 26/1$$

The result as obtained will be clear enough to anyone having any experience, but an explanation may be of value. If the 124 inches which were weighed be divided by the weight, or 1 1-10 grains, the result will be the inches per grain, or 112 7-10. As there are 7,000 grains per pound, the inches per grain times 7,000 will give inches per pound. If this result be divided by 36 inches, it will give the number of yards per pound, and when any given number of yards of cotton yarn weighs a pound, the size can easily be obtained by dividing by 840 yards which is the standard for No. 1 yarn.

Of course, in making any accurate analysis there are also other facts which should be obtained, such as the take-up on the yarn, or yarns used, both warp and filling, and the warp pattern or weave, if the cloth is to be duplicated. The take-up can be obtained approximately by pulling out yarn and measuring the length obtained and comparing it with the length of the cloth woven from it.

As an illustration, the following may make the process clear: A thread is 6½ inches long when it is woven in the cloth, but stretches to 7 inches when pulled out. What is the take-up?

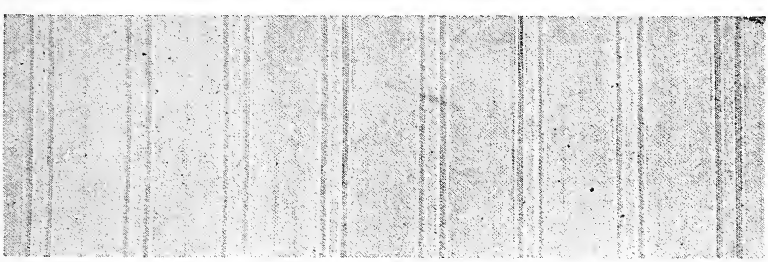
7 inches — 6½ inches = .5 inches.
.5 inches ÷ 7 inches = 7% take-up.

With a little experience, the result obtained in this manner will be entirely satisfactory.

THE PATTERN.

When the fabric has a pattern in it, some kind of a plan must be made if an accurate analysis be desired, but this is only necessary in certain instances in the plan such as we have used in our system of costs. Following we give a plan which may be of service. The first step is to obtain the width of the pattern, and by dividing the width of the cloth by that of the pattern the number of repeats of the pattern may be obtained, and from this result the number of ends or threads of the different yarns in the warp.

Cloth width. 35¾". Selvages, ¼" total.
Pattern width, .51 inch.
35¾" — ¼" = 35½" ÷ .51 = 69 3-5 repeats.
Note that the selvages are narrower than is usually the case.



PATTERN BLUE SAMPLE

	2										2		
60/1 American combed	12	32				4				32	12	=	2,564
30/1 American combed blue........................				2				2				=	276
30/3 American carded			1		1		1		1			=	276
		69 ×											3,116

To make the process as simple as possible, the system as we have planned makes it unnecessary to analyze a piece of cloth so as to be able to find the cost of making. A few items are, however, necessary, and they should be readily understood. One fact which it is necessary to know is the width of the cloth. Another is the threads and picks per inch. On these two facts, together with the take-up and the fundamental facts regarding yarn weights and sizes, the following system is founded. In a general way, the yarn take-ups in ordinary cloths may be about 10 per cent, and we have used this figure in our explanation.

The take-up will probably be more than the amount given on heavy and less on light fabrics, and if more accuracy be desired than that obtained through the use of 10 per cent take-up the threads and picks can be pulled out, and the actual take-up of the cloth noted and averaged, and in this manner a better result be obtained. It is admitted that yarn sizes are much different when finished cloth is being considered, but, due to handling and processing, the yarns are generally finer in finished cloth than they are in grey cloth. Usually, a yarn which is 50-1 in grey cloth will become about 55-1 in finished cloth or, in other words, it will be about 10 per cent finer. This fact should be considered when a finished cloth is being analyzed, or when the cost of making is being obtained.

THE AVERAGE NUMBER.

To make the method clear, we will follow out the process of obtaining the average number from an ordinary fabric. A wide standard print cloth contains 64 threads and 64 picks per inch. It is 38½ inches wide in the grey state and weighs 5.15 yards per pound. If the threads and picks be added together (64 threads plus 64 picks equals 128 total threads per inch), and then multiplied by the cloth width, it will give the number of yards of yarn in a yard of cloth without the take-up on the yarn. This gives as a result 4,928 yards of yarn. As we have previously stated, there is a 10 per cent take-up, and if this be added, the result will be 5,476 yards of yarn (total) in a yard of cloth. As there are 5.15 yards per pound in this cloth, if the yards of yarn per yard be multiplied by the yards of cloth per pound, the result will be the number of yards of yarn per pound (5,476 times 5.15 equals 28,201 yards), If this number of yards of yarn be divided by the standard number of 840, it will give the average size of yarn in the cloth as woven, or 34 (28,201 divided by 840 equals 34). This result forms the basis of estimating the cost of the material which enters into each yard of cloth.

If there be a pattern in the cloth which contains cords or extra threads, all that it is necessary to do is to obtain the number of threads in the pattern and the width of the pattern, and then the total number of ends in the warp can be obtained as previously explained. When there is a check in the filling, the same process can be employed, and by adding the average number of threads and picks per inch together the average size can be obtained, just the same as if only one size of yarn had been used in warp and filling. Following are presented the figures previously obtained so that the process may be clear:

64 threads + 64 picks = 128, total threads per inch.
128 × 38½", cloth width = 4,928 yards of yarn per yard of cloth without take-ups.
10% take-up in weaving.
4,928 ÷ .9 = 5,476, total yards of yarn per yard of cloth.
5,476 × 5.15 yards per lb. = 28,201 yards of yarn per lb. of cloth.
28,201 ÷ 840 standard = 34, average yarn size.

ITEMS OF YARN COST.

The method we have adopted shows in a simple manner how to obtain the average size of the yarns

which compose a fabric, and the next problem is to obtain the costs of these yarns. In obtaining the cost of yarn the first item which is of importance is the cost of the material or cotton. This cost will vary in different years and in different parts of the same year, so that no figures are absolutely reliable except for a comparatively short time after being presented, but a simple rule will serve to make the results very accurate. In the costs, as we have laid them out, the yarn costs are based on cotton which costs 14 cents a pound for Middling Uplands grade at the mill, or on to-day's basis of costs. This makes the cost of cotton about 13¼ cents, as quoted in the cotton exchange. If cotton should decline 2 cents a pound, this amount subtracted from the price of yarn as given will be accurate enough for all ordinary purposes, and if the price of cotton should advance, any extra charges over the 13¼ cents, as quoted on the exchange, should be added to the price of the yarn as given. The finer yarns are, of course, made from longer staple cotton, but it has been found that the advances for the different lengths of staples are quite regular, and that if the advances or decreases noted on Middling Uplands grade be added to or subtracted from the yarn costs as given and made from longer staple cotton, the results will be entirely satisfactory. The price of Middling Uplands can always be obtained from any good textile paper.

LOSSES IN PROCESSING.

When the price of cotton has been obtained there are, of course, certain losses in processing at the mill which make the net cost of cotton in the yarn somewhat higher than it was when purchased. We have considered normal conditions in the amounts of waste made and in the extra price made necessary through this loss, and, of course, the loss on combed yarn is much higher than that for carded yarn.

In addition to the price of material in the yarn is the cost of the labor of spinning it and getting it in a condition ready to weave, and also the various expenses such as supplies, insurance, depreciation and the other costs necessary in the processes of making yarn. Yarns are not all made with the same amount of twist, and because the twist will vary, the production per spindle will vary, and, naturally, when the production varies, the cost of making will vary, but for normal yarns the cost of the cotton forms such a large proportion that a small variation in production does not greatly affect the total cost of the finished material.

COMBED YARNS.

Not only do combed yarns have a greater loss in cotton but they also have a somewhat larger expense in making, and this has been considered in calculating the costs. Then it is also true that warp yarn made from a certain cotton is likely to be of a coarser size than filling made from the same length of staple. Thus, 30s-1 warp might be made from 1 1-16-inch staple, while the same staple would be used in filling as fine as 40s-1. As we have only given one cost, which is the average for both warp and filling, the change in length of staple comes at a higher number than it would if warp and filling had been considered separately, that is, by obtaining an average price the cost of, say, 44s-1 yarn would be rather low for warp and high for filling, but is a fair average.

Admitting that there are certain faults in treating the subject as we have, but which are due to the fact that it is a short system and one which can be used by those not acquainted with a great amount of technical detail used in cloth making, we give the following table of yarn costs for both combed and carded yarns:

YARN COSTS FOR COMBED AND CARDED YARNS.

Including All Costs up to the Weave Room.

Size.	Carded. (Cents per pound.)	Combed. (Cents per pound.)
10	14.68	22.14
12	14.92	22.50
14	15.18	22.69
16	15.46	22.99
18	15.74	23.29
20	16.02	23.61
22	16.34	23.95
24	16.66	24.31
26	19.22	24.63
28	19.56	25.01
30	19.92	25.40
32	20.30	25.82
34	20.67	26.23
36	23.27	26.60
38	23.68	27.04
40	24.05	27.44
42	24.47	27.91
44	24.95	28.42
46	27.63	31.51
48	28.12	32.05
50	28.60	32.56
55	29.77	33.86
60	33.08	37.62
65	34.58	39.23
70	.....	43.39
75	.....	45.09
80	.....	49.49
85	.....	51.52
90	.....	56.21
95	.....	58.44
100	.....	63.11

METHOD OF USING YARN KEY.

We have previously explained how to obtain the average number in any piece of cloth, and it is a simple process, for all that is needed is the total average threads and picks per inch, and by actually weighing the cloth, the average size of the yarn can be obtained. Buyers can obtain the weight of the cloth and the count because it is usually given in the contracts made, but when it is not available, it can be very easily obtained. We have found that the average size of yarn in the standard print cloth is about 34s-1. By referring to the table we find that for carded yarn the cost of making, including the cotton, is 20.67 cents per pound. This cloth weighs 5.15 yards per pound, or .194 pounds per yard. If this cost be multiplied by the actual weight per yard of the cloth, the cost of the material can easily be obtained, which enters into each yard of the cloth, (20.67 cents per pound times .194 equals 4.01 cents, cost of material).

Some buyers may not be able to distinguish which fabrics are made of carded yarn and which of combed yarn. When a buyer makes a contract this is usually stated, but for those who are not in position to obtain this information, it can be said that the cloth appearance in a large number of cases will make this fact plain.

When yarns are finer than 60s-1 they are almost always made from combed stock, while there are also all the mercerized fabrics and most of the piece-dyed fabrics which are made from combed stock. When a piece of grey cloth is obtainable, or when it is being analyzed and if it is made of carded stock there is likely to be a good many small specks which are not often present when the combed yarn has been used. Cloth made from carded yarn is also likely to have a certain amount of roughness which is not present in combed work. A little experience will enable one to estimate pretty accurately whether a fabric has been made from carded or combed yarn. If combed yarn has been used, the prices should be used as given under the combed heading in the table.

CLOTH COSTS.

We have already shown a method by which the average size of yarn in any piece of cloth might be obtained, and have also given a table in which there are included the price of material, labor, expenses and other details necessary in the making of yarn. With the average number and the average price, the cost of the material in the yard of cloth is easily found, but there are other costs which are necessary before the total cloth cost is obtained. These are the costs of weaving and the expenses which naturally go with it, together with the expenses incurred in selling the cloth.

It must be admitted that there are a very great number of costs possible for weaving any certain kind of cloth. In the first place, there are

certain fabrics which are being woven on ordinary looms, and at the same time, being produced in other mills on automatic looms, and, naturally, the cost of production will vary. Then it is also true that one mill will use a somewhat shorter staple of cotton in its yarn and then run its looms somewhat slower and with a consequent loss in percentage of production. Other mills will use a better quality of cotton which costs more, and, therefore, be able to run the loom somewhat faster and obtain a greater percentage of production.

Each mill has certain problems which are individual and which must be worked out to their own satisfaction, but the variation taken all together for yarn and cloth is not so great as many suppose to be the case. There are so many automatic looms in operation in the domestic market that they should be considered when the price is being obtained on any ordinary fabric which can be produced on them. Under such circumstances, practically all kinds of plain cloth, sateens, twills, plain shirtings, duck, denims, sheetings, towels, drills, lawns, cambrics, pillow tubing, ginghams, flannels, etc., should be considered as woven on automatic looms, for they do make the price lower. It is often a fact that a certain cloth is being made on automatic looms and is returning a fair dividend at a certain price, while it is also true that the same fabric is being made on ordinary looms, and is returning the manufacturer practically no dividends.

A fact which is of importance in any cost is the relation of prices to costs. The price of cloth to-day shows a high profit when automatic looms are used, and a medium one where non-automatic looms are used, but the price of cotton to-day is high, and many manufacturers are using cotton in the cloth which they are selling which actually costs them 2 cents a pound less than the present price, and which on an ordinary wide print cloth would return them about two-fifths of a cent per yard more than if they found it necessary to buy their cotton at to-day's price. This two-fifths of a cent per yard will make a difference in profit obtained of from 7 to 8 per cent and explains why profits do not appear any higher in our estimates. In obtaining any cost of yarn the cotton cost must be first checked up and then the process is simple.

We have given one table which contains the cost of weaving, including the expenses per loom and the selling costs per yard for cloths containing from 20 to 124 picks. Our yarn cost contains everything up to the weaving operation, while the cloth or weaving cost embraces everything which is not included in the yarn costs. Recognizing that loom speeds will vary and that percentages of production will vary also, we present the following table, which, together with the yarn costs, will give the cost on all ordinary fabrics. We have given the cost which should be noted with a moderate loom speed with a rather low percentage of production and a comparatively small number of looms per operative. Many mills are able to do much better than the figures given in the table, but for average conditions, the table will be found to be very accurate.

PLAIN CLOTH COST.

Including All Costs Beginning With Weave Room.

Picks.	Costs per yard.	Picks.	Costs per yard.
20	$0.0025	70	$0.0096
22	0.0028	72	0.0099
24	0.0031	74	0.0102
26	0.0034	76	0.0105
28	0.0037	78	0.0108
30	0.0040	80	0.0110
32	0.0042	82	0.0113
34	0.0045	84	0.0116
36	0.0048	86	0.0119
38	0.0051	88	0.0122
40	0.0054	90	0.0125
42	0.0057	92	0.0128
44	0.0060	94	0.0130
46	0.0062	96	0.0133
48	0.0065	98	0.0136
50	0.0068	100	0.0139
52	0.0071	102	0.0141
54	0.0074	104	0.0144
56	0.0076	106	0.0147
58	0.0079	108	0.0150
60	0.0082	110	0.0153
62	0.0085	112	0.0156
64	0.0088	114	0.0159
66	0.0091	116	0.0162
68	0.0093	118	0.0164
		120	0.0167
		122	0.0170
		124	0.0173

As we have already explained the method of obtaining the yarn size in any piece of cloth and through the table of yarn costs we have been able to find out how much the cost of material is for each yard of cloth, the foregoing table will enable us to ascertain all the other costs which we have not included in the cost of the yarn. As we figured previously, the cost of material or yarn in a yard of ordinary print cloth, 38½ inches wide, was 4.01 cent. By referring to the table of costs given above, it will be noted that for a plain cloth with 64 picks the cost of weaving and expenses is $0.0088, or a total cost (4.01 cents plus .88 cents equals 4.89 cents). This cloth is to-day selling for about 5½ cents, thus giving a profit of .61 cents a yard. With a normal production per loom this will give a net profit of at least $70 per loom per year, although many mills, through their longer hours and greater percentage of production, would obtain more than this amount. Seventy dollars a loom per year will give a profit on a fair loom valuation of 11 or 12 per cent. Thus it will be seen that any manufacturer who purchased his cotton the present season at 12 cents per pound at the mill is obtaining, with prices of cloth at the present levels, a profit of at least 20 per cent.

In many cases, the profit obtained is more than this amount, for we have not given in our estimates any low figures for any single item, but have confined ourselves to normal conditions which should be noted in every representative mill. With the foregoing explanations, it should be an easy matter to obtain the approximate cost of any cotton fabric which is made on an automatic loom.

FANCY CLOTH COSTS.

As we have already stated, there is quite a variation in loom speeds and percentages of production on plain cloths, but there is an even wider variation in the above items on fancy cloths. The cloth constructions made and various other items, are likely to affect the results, and even to the mill which makes the cloth the results obtained are often not ascertainable. The analysis of a fancy cloth or the finding of the average number of yarn used is no different than for a coarser fabric. It is, however, a good policy to find out the take-ups and use the ones found when making an estimate for the yarn size. There are so many varied conditions that only normal cloths can be considered. Such fabrics as all-over lenos or ones on which there is a higher weaving expense, or where less looms than usual per weaver are run, of course cannot be considered on any average basis, because the weaving cost is so high.

The weaving of fancy cloth has, however, become more systematized during the past ten years, and where there is a style which does not run especially well, it is usually placed in a set of looms in such a manner that it is operated on a basis not much, if any, different than other normal fancy fabrics. Jacquard looms a few years ago were fewer in number to a weaver than they are to-day, and in a great many instances, for ordinary straight tie-up machines the number of looms per weaver is as many as it is for ordinary fancy cloths. For this reason, fancy dobby cloth and ordinary jacquard cloth can be considered on the same basis.

FABRIC WIDTHS.

It would be well to remember that all of our costs as given apply to ordinary fabrics, that is. ones up to 41 or 42 inches wide in the grey. Fancy fabrics are not often made in the domestic market much over 36 inches wide in the grey state. but there are many imported fabrics in these lines which are up to 46 or 47 inches wide in the finished state.

There are many plain fabrics, however, which are made wider than 40 inches in the domestic market, but we have not attempted to present costs on such fabrics, although they will not vary greatly from those giv-

en in our table, inasmuch as the material forms such a large proportion of the total cost. Fancy mills usually have quite a variety of looms in their organization, and all these looms cost different amounts, but it is almost impossible to separate the various items and place them on a different basis, and for this reason, ordinary jacquard cloths such as shirtings, waistings and silk and cotton mixtures are sold on practically the same basis of cost as ordinary dobby fabrics. The difference in costs is so slight that for all practical purposes they may be considered on the same basis.

MILL PROFITS.

So far as the profits of a mill or the selling price of cloth is concerned, it can be said that these are largely the result of conditions affecting the sale of goods. Fancy cloth mills, or at least many of them, attempt to obtain a net profit of about $2 per loom per week, or about $100 per loom per year, which gives at least a net profit of 10 per cent if the mill be arranged for expensive cloths, while it gives more than 10 per cent profit if an ordinary fancy mill be considered.

The profit per yard will vary depending upon the number of picks per inch, for it would not be a correct policy to expect a 30-pick cloth to return as high a profit per yard as one containing 100 picks. A cloth which was being produced at the rate of 200 yards per loom per week and which was showing a net profit of 1 cent per yard would return about $2 per week, or about $100 per year. A plain cloth does not need to carry the same amount of profit, because the total cost per loom of the mill is less for plain cloth than it is for fancy cloth making. Understanding all the above conditions and realizing that there are radical cloths which cannot be considered under any but an individual basis, we present the following table which includes all the costs of fancy cloth weaving.

FANCY CLOTH COSTS.

Including All Costs Beginning With the Weave Room.

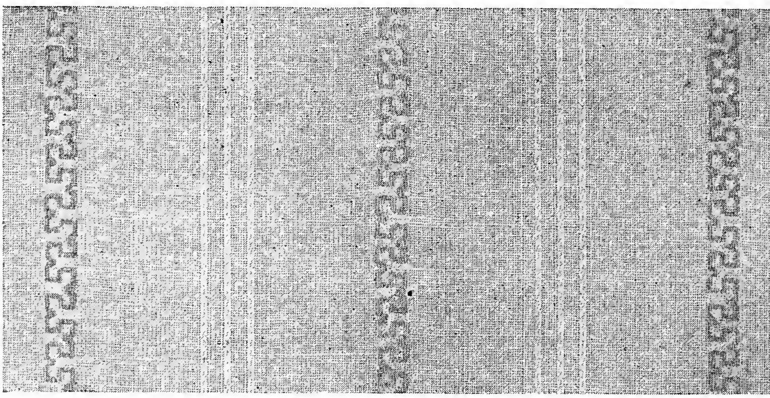
Picks.	Costs per yard.	Picks.	Costs per yard.
20	$0.0072	70	$0.0274
22	0.0080	72	0.0282
24	0.0088	74	0.0290
26	0.0096	76	0.0298
28	0.0104	78	0.0306
30	0.0112	80	0.0314
32	0.0120	82	0.0323
34	0.0128	84	0.0331
36	0.0137	86	0.0339
38	0.0145	88	0.0347
40	0.0153	90	0.0355
42	0.0161	92	0.0363
44	0.0169	94	0.0371
46	0.0177	96	0.0379
48	0.0185	98	0.0387
50	0.0193	100	0.0395
52	0.0201	102	0.0403
54	0.0209	104	0.0411
56	0.0217	106	0.0419
58	0.0225	108	0.0427
60	0.0233	110	0.0435
62	0.0241	112	0.0443
64	0.0250	114	0.0451
66	0.0258	116	0.0459
68	0.0266	118	0.0467
		120	0.0475
		122	0.0483
		124	0.0491

METHOD OF FINDING COST ILLUSTRATED.

Possibly an illustration of the method as used on a fancy fabric may make the process of finding the cost more evident. An ordinary fancy cloth which is sold in large quantities is the one which contains 64 threads and 72 picks per inch. It is 34 inches wide in the grey state and weighs about 6.30 yards per pound. This cloth is made from combed yarn and is used extensively in piece mercerization. As previously explained 64 threads plus 72 picks equals 136, the total threads per inch. Then we have 136 times 34 inches cloth width equals 4,624 yards of yarn per yard of cloth, not including the take-up in weaving. As previously noted, 10 per cent is a fair average for this take-up, 4,624 divided by .9 equals 5,138 total yards of yarn per yard of cloth. 5,138 times 6.30 yards per pound equals 32,369 yards of yarn per pound. To find the size, this number of yards should be divided by 840, the standard for number 1 yarn. Then we have 32,369 yards divided by 840 standard equals 38.1, the average size of yarn in the cloth.

By referring to the table for yarn costs we find that the average price of combed 38s-1 yarn is 27.04 cents per pound. As this fabric contains 6.30 yards per pound the weight per yard is 1.0000 divided by 6.30 or .159, the weight of the cloth per yard. Then we have 27.04 cents times .159 equals 4.30 cents, the cost of the material per yard of cloth. Again, referring to the table of weaving cost, we will find that the total expense and labor for a 72-pick fancy cloth 2.82 cents, so 4.30 cents plus 2.82 cents equals 7.12 cents, the total cost of producing this fancy fabric. To-day's quoted price for the above cloth is 8⅝ cents, so the difference between the cost of making and the selling price represents the net mill profit. 8.625 cents minus 7.12 cents equals 1.505 cents profit per yard. This is practically 1½ cents per yard, and assuming a normal percentage of production for the fabric being considered, the profit per loom per week would be about \$2.25, or per year about \$117. This should give a net profit to a mill of anywhere from 12½ to 15 per cent.

Prices are somewhat higher to-day than they have been for all kinds of fancy cloths, but most of these fabrics are now showing very good margins of profit. In assuming a loom production care must be taken to make the estimates low enough to cover all conditions, that is, a fabric might average 85 per cent production after the loom was started, but, due to certain circumstances, much time might be lost in getting the warps into the looms, so that for six months' or a year's time the actual average percentage of production might be nearer 75 per cent, and as a loom does not earn profits when standing idle, only actual percentages are of value. This policy has been observed in the various costs which we have presented in the tables.



Sample of Cloth for Which the Cost Is Given.

COST OF CLOTH CONTAINING FAST COLORS.

Probably the greatest increase in any one line of fabrics has been that which applies to grey cloths in which yarns fast to the bleaching process are being used, and, inasmuch as a still greater use is imminent, it may be well to give a method of obtaining this cost. For such fabrics the average size of yarn can be obtained just as in the other samples we have considered. When the threads are being counted the number of colored threads per pattern can also be obtained, and by measuring the width

of the pattern and finding the repeats of the pattern in the cloth the total colored threads in the warp or filling can be obtained.

When the total number of colored threads are known, it is easy enough to find the percentage of the total cloth weights, at least approximately, which they form. By adding 18 cents as an average cost for dyeing fast colors per pound to the cost of the regular yarn and then multiplying by the two weights (that of the grey warp and that of the colored) the cost can be determined. An illustration will, without doubt, make the process clear enough so that it can be generally understood. The cloth illustrated is made on a fancy loom. It is 33 inches wide in the grey state, or as it comes from the loom, and the stripes are 1 8-10 inches wide. Then 33 inches, the cloth width, divided by 1 8-10 inches, the width of the stripe, equals 18 colored stripes in the cloth width. The fabric weighs when woven about 6.00 yards per pound. The following figures should make the results readily understood:

Warp count. 95 (over all).
Filling count. 80.
95 + 80 = 175, total cloth count per inch.
175 × 33″ cloth width = 5.775 yards of yarn per yard of cloth without take-up.
18 stripes × 14 colored ends = 252 colored ends in fabric.
252 ÷ 5.775 = 4.36% of color in fabric.
10% take-up in weaving.
5,775 ÷ .9 = 6,417, total yards of yarn per yard of cloth.
6,417 × 6.00 yards per lb. = 38,502 yards of yarn per lb.
38.502 ÷ 840 standard = 46/1, average yarn size.
1.0000 ÷ 6.00 yards per lb. = .167, weight per yard.
.167 × .0436 = .007, weight of colored yarn.
.167 — .007 = .160, weight of grey yarn.
31.51c. per lb. × .160 = 5.04c., cost of grey yarn
31.51c. + 18c. = 49.51c., cost or colored yarn per lb.
49.51c. × .007 = .35c., cost of colored yarn.
Weaving cost = 3.14c. (from table).
5.04c. + .35c. + 3.14c. = 8.53c., total cost of cloth as illustrated.

CREPE RATINÉ NOVELTY

We have at various times called attention to the fact that there has been a great improvement in the styles and quality of the various fancy fabrics which are being produced in domestic mills. These fabrics have been growing in favor very fast, and the prices which are being obtained for them are much greater than was ever thought possible only a few years ago; in fact, there are many instances wherein cotton fabrics seem to be displacing certain kinds of worsted materials. This has resulted because of changes in living conditions, and it is very likely that such changes will be even more noticeable in the future than they have up to the present.

Inasmuch as higher prices have been obtainable, this fact has permitted manufacturers to produce fabrics which they formerly could not make, and has resulted in quite a little change in manufacturing conditions. At present, the tendency appears to be to order quite a number of styles from a mill, but comparatively small quantities, while previously fewer styles were purchased with larger quantities of each individual fabric. Naturally, such buying conditions have made the cost of production increase at the mill and have created other difficulties for the manufacturers, but it seems as if such conditions must be accepted by the manufacturers and surmounted in the best way possible.

We have also called attention to the fact that the three styles of cloth which seem to be in greatest demand are those produced from

NOVELTY YARNS,

and which are generally known as ratinés or eponges, and also the fabrics known as crepes and voiles. All these fabrics represent methods of manufacturing which are unusual, in that they are different from ordinary manufacturing in certain respects. Ratinés or eponges from the nature of the yarn used are a comparatively heavy-weight fabric when compared with most lines of cotton cloths, while crepes and voiles are relatively light fabrics.

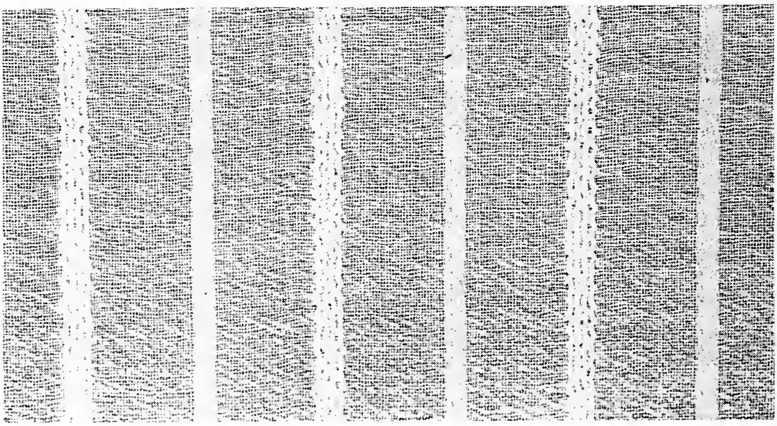
Naturally, one would hardly expect these ideas to be used in combinations, nevertheless, many of the fabrics which are being produced for next spring's sale have all of these ideas, or

some of them, in combination, or at least they contain methods by which these effects are produced. Such fabrics as those illustrated and described are used for dresses, waists and many other similar purposes where a light-weight fabric can be satisfactorily used and where consumers desire to use something which expresses the latest ideas in fabric construction.

PRODUCES CREPE EFFECT.

Some time ago, fabrics were produced which were generally known as crepe voiles. These cloths were neither a crepe nor a voile, but they had some of the characteristics of both fabrics. The method of production consisted in using a comparatively fine single yarn in most cases, but with a slightly greater amount of twist than usual and a weave was used of an uneven character which produced a sort of irregular or crepy impression in the fabric. Most of these fabrics were made of medium or fine yarns and when any weave is applied to such a fabric it does not show prominently, because of the fine character of the yarns. This condition helps a great deal in permitting a crepy effect to be produced, and still allows the weave to be rather indistinguishable, so that no definite pattern can be noted.

The voile effect is produced through the extra twist which is inserted in the filling, and in certain instances in the warp, although this extra twist is not as great as when a real voile cloth is being produced. In a good many instances the standard of twist for such fabrics for the filling was about the same as for warp, namely, 4¾ times the square root of the yarn size in turns per inch. Because the yarns used are single instead of two-ply, as in ordinary voiles, the effect produced is not as clear as in most voiles, but nevertheless, there is that crisp condition noted in voiles together with a moderate amount of openness. Such fabrics usually have a rather low construction in threads and picks per inch, although is it usually higher than for most ordinary voiles. In a good many instances where such fabrics are produced no extra twist is inserted in either yarn, the weave alone making the crepy effect, although in the representative fabrics a certain amount of extra twist is used.



Crepe Ratiné Novelty.

Inasmuch as these

CREPE VOILES

have had, and are having quite a large sale, the idea is still being used, but

because novelty yarn fabrics have been especially desirable, many of the newer fabrics contain various kinds of novelty yarn in stripes and checks, thus adding quite a little to the attractiveness of the material and making them more desirable when the style is considered. Possibly there are more of such fabrics being developed for another season's use than any other one idea excepting the entire novelty yarn fabric, generally known as ratiné. With such large quantities being produced it is very easy to believe that prices will decline appreciably before another summer is over.

AN ORDINARY PRODUCT.

One of the interesting features regarding the present large production of novelty yarn fabrics is that only about two years ago it was generally claimed by most mill men and others that these novelty yarn fabrics could not be produced in domestic mills, because the machinery was not suitable. Such an idea has been proven to be entirely false, inasmuch as practically every mill in the country today which pretends to make any kind of novelty cloth, and many which have formerly made nothing but plain material, are now producing goods containing certain kinds of these novelty yarns. It is admitted that certain of these novelty yarns require special machinery for their production, but not many of such yarns are being used, and without doubt, mill men have learned more about yarn combinations and the production of novelty results in the past year than they learned in the preceding decade. Many of these novelty yarns are produced through the twisting of various sizes of single yarns.

In the fabric under discussion the novelty yarn is produced through the twisting of three threads of two-ply yarns. In the first twisting operation two ends of approximately 18s-2 yarn are twisted together, these being delivered at different speeds. In a second twisting operation, in the reverse direction, this first twisted yarn is again twisted with a single end of 60s-2. Because of the use of two-ply yarns, the resulting novelty material does not contain as decided loops as many of the ordinary novelty yarns, being somewhat similar to many of the ordinary corkscrew yarns, although it is not, strictly speaking, such a product. The heavy two-ply yarns are made form carded material, while the fine two-ply yarn used in the second twisting operation is made from combed stock.

The heavy nature of this novelty yarn shows quite a contrast to the rest of the fabrics, and this is one reason why the use of novelty yarns seems so desirable, inasmuch as it offers

OPPORTUNITIES IN CONTRASTING

effects not formerly possible in any great number. This fabric has in addition to the stripes of novelty yarn a satin stripe of an ordinary character. This is produced through the crowding of ends in a few dents, these ends weaving in a regular satin manner and showing a contrast to the ground work of the fabric. Ordinarily, the weave which is used on the ground cloth to produce the crepe effect is made upon either 12 or 16 harnesses. Sometimes it is rather difficult to produce a weave of this nature, in which there are no streaks either in the warp or filling. The use of stripes in a pattern will often eliminate any trouble of this nature, inasmuch as it breaks up the ground weave and does not make the weave defects so prominent.

A fabric of the character described cannot be produced in an ordinary plain cloth mill, because it is necessary to use quite a number of harnesses in its production. Naturally, looms must be available with these harnesses, so that for this reason a fancy cloth mill would have to produce the material. In addition, the wide variety in yarn sizes would not be possible in a plain cloth mill unless the yarns were purchased, and to get yarns of this character, at the present time, is likely to eliminate the possibility of obtaining the very satisfactory profits which can be secured from such cloth making.

Certain of these fabrics are also woven with a jacquard weave and naturally this makes it necessary for them to be produced in a fancy mill

There are also a few mills in the domestic market which produce carded and combed work, although not prepared to make fancy materials. The satin stripes in a fabric of this character are sometimes placed upon a separate beam, although in other instances the stripe yarn is placed on the same beam as the yarn producing the ground work of the fabric. Whether these threads can be placed on the same beam as the ground yarn is largely a matter of experience and judgment. Usually, this method can be adopted if the threads are placed correctly in the reed. When they can be placed upon one beam it aids in reducing the cost of production and makes less trouble in the weave room.

The adoption of every possible economy when making such fabrics is one reason why the profits of some mills are higher than others. In making fabrics of this character, the orders are smaller than when staple lines are being produced, therefore the styling and sample piece expenses are likely to be greater than for ordinary fabrics. The correct adoption of any good cloth idea and the use of it in various styles usually permits good profits to be secured.

PRICES SHOW VARIATIONS.

The selling prices on fabrics of this character are largely determined by the market conditions which exist. One style of fabric may sell for approximately 9 cents a yard and a very similar fabric may sell for 11 cents a yard, the difference being brought about through the higher cost of production in one case and the ignorance of the buyer who is willing to purchase at the higher price through his ability to dispose of it at a satisfactory profit. In connection with this foregoing statement, it may be well to state that when any new idea is produced, profits are usually excessive, not only because the idea is desirable and in demand, but also because buyers have no idea regarding relative values and often pay much more than a fabric is worth. Recently on certain styles of novelty yarn fabrics we have seen exceptional values in fabrics at $1 a yard when the cloths were first shown, and in comparison other fabrics selling at twice as much did not seem anywhere near so desirable, neither did they cost as much to produce when the selling price was considered. The same thing is noticed to a greater or less extent in all the novelty yarn fabrics being produced to-day.

Everyone, through extended discussions of a number of years ago, obtained the idea that the novelty yarns used are very expensive to make and, therefore, the fabrics in which they are used could not be anything but expensive; and for this reason a buyer is often willing to pay an excessive price for a fabric, through the fact that he has purchased nothing in the past on which a comparison can be made and because he knows he can sell at a profit he does not consider the purchasing price.

This condition will gradually disappear, bceause the demand for these fabrics is now at its height and much greater amounts are being produced on what might be called a declining market. Under such conditions there will be much more opportunity for comparison by buyers, and some of the fabrics will have to be sold at low prices, for it is not believed the consuming public will absorb the great quantity of such fabrics now being produced.

NOVELTY YARN FEATURES.

The main feature of interest in a fabric of this character is to obtain correctly the various amounts of materials which are used in making the novelty yarns. If all the yarns used in making this product are purchased then it is a comparatively simple matter to obtain the total cost, but where various other features are involved such as the production of single yarns, then twisting these single yarns, and in addition two other twisting operations to produce the novelty effect, care must be used or results will not be correct. It is usually a good plan to check up the actual

weight of the novelty yarn with the figured weight, which is obtained through the sizes of the various yarns and the take-ups noted in their twisting. If this is done the correct weights used in making the novelty material can be obtained and results will be fairly accurate. In the yarn used in the fabric considered, results are not so difficult to obtain as they would be in many of the yarns produced, because a comparatively large portion of the yarn is produced from nothing but 18-2 yarns. When more yarn sizes are used, as is often the case, the correct result is more difficult to obtain, although the method used is similar to that employed in obtaining the cost of the yarn considered.

To the

COST OF THE MATERIALS

used in making the yarn must be added the costs and expenses of the two twisting operations, and in addition, there must be a sufficient amount allowed for the experimentation which must be done when making many of these yarns. Usually the production of many of these yarns is quite large in pounds per week, so that the costs of twisting are not so high as might be imagined, even though there are two twisting operations employed. The mill profit on many of these goods is quite high and depends a good deal upon the size of the order and naturally upon the price obtained. The production in yards per day or per week is quite large, although not nearly so large as when ordinary plain cloth with the same number of picks is being produced.

The present fabric selling at 8¼ cents per yard should net many of the mills producing such fabrics a profit of at least 15 per cent, and it is a known fact that many of these novelty fabrics have been producing returns in excess of 25 per cent. The reason mill profits have not shown these facts is because the orders secured have not been sufficient to operate the entire equipment of machinery and partly because fancy mills contain many plain looms on which there has been no profit and in some cases a loss. The above figures are merely the rates of profit which would be noted were the looms employed as fully as is normally possible.

WHITE FABRICS IN FAVOR.

From the cloth plan as laid out it will be noted that this fabric falls into the regular 25-cent retailer and allows a profit slightly in excess of the ordinary amounts to the various sellers. The converter should be securing a profit somewhat higher than is ordinarily secured on fancy cloths and the same condition is noted in regard to the jobber and retailer. When such cloths are sold direct by the converter to the retailer the profits secured are naturally much higher than those given, although the expenses of selling to the converter are somewhat greater than when the cloth is sold to the jobber. The filling yarn will be somewhat more expensive than when ordinary filling is considered, because the production is not quite so high, due to the extra amount of twist, and as the production decreases the cost increases. It will be noted that 50s-1 warp costs somewhat more than the 50s-1 filling to produce, even though the standards of twist are approximately the same.

Due to the decreased handling, it is possible and customary to use a shorter staple of cotton for filling than for warp, and this is responsible for a large part of the difference noted, although, naturally, the warp yarn carries expenses which the filling does not and which are incurred by the extra processes necessary in producing the warp yarn. A good many of these fabrics are sold in the white state; in fact, converters generally believe that white fabrics are increasing in demand and have increased their lines of such materials for the coming season. There are, however, many such fabrics which are dyed various colors, and in a few instances, printed patterns are employed. In addition to being dyed, many of these fabrics are also mercerized, a process which, while increasing the cost, is re-

sponsible for an added attractiveness that makes its adoption worth while. We have not given the method of obtaining the novelty yarn size, inasmuch as we have previously presented such methods on certain of these novelty yarns. The cost of the yarn is obtained as explained in previous articles. Other than these two features the method of obtaining the weights of the yarn and the cloth is no different from ordinary fabrics and the process is a simple one as follows:

1,870 ends ÷ (50/1 × 840) = .0445, weight of 50/1 warp without take-up.
6% take-up in weaving.
.0445 ÷ .94 = .0473, total weight of 50/1 per yard of woven cloth.
80 ends ÷ (3.3/1 × 840) = .0288, weight of novelty warp without take-up.
2% take-up in weaving.
.0288 ÷ .98 = .0294, total weight of novelty yarn per yard of woven cloth.

$$\frac{64 \text{ picks} \times 28\tfrac{1}{2}'' \text{ reed width} \times 36''}{36''} = 1{,}824$$

yards of filling per yard of cloth.
1,824 ÷ (50/1 × 840) = .0434, total weight of 50/1 filling per yard of cloth.
.0473 + .0294 + .0434 = .1201, total weight per yard of cloth.
1.0000 ÷ .1201 = 8.33 yards per lb. (grey).

PATTERN.

50/1 Am. combed warp	52	28	62	28	28	52	=	1,870
3.3 novelty		4		4			=	80
		19 ×						1,950

50/1 Am. combed filling (warp twist); 64 picks.
32 reed, 28½" width in reed, 27" grey width, 26" finished width.
72 × 64 grey count over all, 75 × 63 finished count over all.

YARNS.

	Cotton.	Labor, waste, etc.		
50/1 Am. combed, 1 5-16" staple; 10 hank dou. rov.,	21c.	16½c.	=	37½c
50/1 Am. combed fill'g, 1¼" sta.; 12 hank dou. rov.,	19c.	15½c.	=	34½c
Novelty (4 ends 18/1, 2 ends 60/1), total cost including twisting			=	29¼c.

COST.

1,870 ends 50/1 Am. combed + 6% take-up	= .0473 @ 37½c.	=	$ .0178
80 ends 3.3 novelty + 2% take-up	= .0294 @ 29¼c.	=	.0086
64 picks 50/1 Am. combed, warp twist	= .0434 @ 34½c.	=	.0150
Weaving			.0108
Expenses			.0132
			$ .0654
Selling (grey)			.0015
Mill cost (grey)			$ .0669
Mill selling price (approximate)			.0825
Finishing			.0150
Cost to converter (not including expenses)			$ .0975
Cost to jobber			.1300
Cost to retailer			.1700
Cost to consumer			.2500

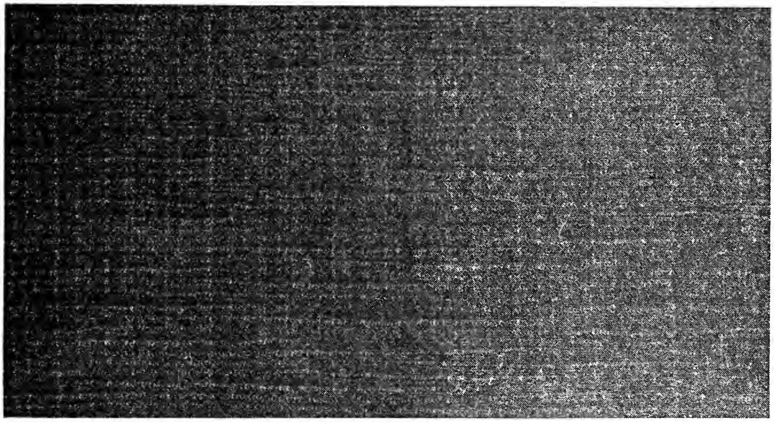
Yards per pound 8.33 (grey).

MERCERIZED DRAPERY NOVELTY

Possibly one of the most interesting portions of the cotton cloth industry, but one which is not very often commented upon, mainly because the producing units are rather small and few when compared with those making staples and even fancies, is that portion which produces various drapery, upholstery and similar fabrics. Due to the use of better dyes and the production of more desirable and harmonious effects, these materials have been increasing in sale and are being used for purposes where they previously were considered unsuitable. In a general way, such fabrics are made from dyed yarns and are heavy in weight when compared with most lines of cotton fabrics. The selling prices are high because the cloth contains so much material per yard and also because the quantities sold are rather small, thus making distribution charges large and the costs of production greater than would otherwise be noted.

That the changes of style in dress goods do have a wide influence upon

various fabrics is not often recognized by many sellers, but it is clearly shown by the style of fabric we have analyzed and which is illustrative of some of the leading fabrics which have been produced for drapery purposes. It is a well known fact that novelty yarn effects have been the leading styles in dress goods and have been adapted in various methods for use with such ground fabrics as voiles, crepes, curtain materials, light waistings and other widely varying constructions, and so it is natural to expect the same influence to be noted in draperies. Of course the possibilities in the use of novelty yarns for drapery fabrics are rather limited for various reasons, but it is usually desirable to produce new effects when they can be cleverly executed and when they will aid in the distribution of any fabric.



Domestic Mercerized Drapery.

CLOTH CONSTRUCTION.

One of the processes which is used extensively in making ordinary drapery fabrics is the poplin construction. This is a method by which the warp contains a comparatively large number of threads per inch of rather fine yarn and usually of a ply nature, while the filling contains a small number of picks of coarse ply yarn. It is seldom that there is less than twice as many threads per inch in the warp than there is in the filling, usually a much higher ratio than that named, and for draperies the warp size is usually twice or more than twice as fine as the filling. In the cloth analyzed the count is 100 x 17 and the yarn sizes used are relatively 30-1 and 3.8-1. The weave is, in the majority of instances, plain, inasmuch as more firmness is secured through such use and there is not the great necessity for woven figures which there is in many styles of dress goods, although this statement does not indicate that figures are not sometimes applied.

Ply yarns are used in making such fabrics for a number of reasons. First, they allow coarser yarn numbers to be made so that heavier fabrics result. Second, they permit a greater amount of strength and service to be secured together with a clearer result, which is desirable in draperies. Third, they allow many mercerized yarns to be used, thus giving the material a luster not obtainable when single yarns are employed. Soft twist is necessary for any good mercerized results, either in yarn or cloth, and for this reason soft twist ply yarn is often used.

In a poplin construction the large excess of warp has a tendency to cover up the filling to a greater or less extent, and under such circumstances the quality of the filling yarn is not of such great importance as the warp, and, in addition, the fabric pattern, if made by colors, must be produced by the warp yarns. In the cloth considered the ribs of the ordinary poplin cloth are noticeable, but these ribs are made irregular through the variation in the size of the filling yarn. The warp covers up the filling just about as effectively in the heavy portions as it does in the finer portions, but, nevertheless, the irregular filling yarn produces a noticeable irregular effect in the cloth and this shows that a great deal of ingenuity has been used in the planning of the cloth construction. Many of the novelty loop, corkscrew, and nub yarns would not have been suitable for the style of cloth considered, and the fact that the right yarn has been used is worthy of mention. The same poplin constructions which are used for draperies are often used for other purposes; in fact, in many instances, fabrics are intended for a number of different uses when their production is planned.

NOVELTY YARN MAKING.

We have at various times described the processes by which certain of the novelty yarns now being extensively used are produced, but inasmuch as the yarn used in this cloth differs essentially from those previously described a short explanation may be of value. Certain classes of cloths, such as cotton flannels, regularly contain yarns of the character used in this fabric, and while the yarn sizes may vary somewhat, the method of production is practically identical. In the first place, the novelty result is produced from a number of strands of yarn and bunches of loose cotton twisted together, the bunches of cotton being spaced at intervals in the completed yarn. The loose cotton necessarily has to be in a condition capable of being handled and the fibres must be comparatively parallel so as to give some strength together with a uniform size of bunch when the yarn is being made.

There are a number of different results which can be produced. First, the whole yarn can be made from stock-dyed cotton with the bunches of one color and the ground threads of the same or another color. Second, the ground yarns can be spun in the grey state and then dyed and used with stock-dyed cotton of the same or a different color. Third, the whole yarn can be made from grey yarns and grey cotton, and this result afterward dyed, although solid colors only are possible by this method. Naturally, in the first two processes the ground yarns can be of different colors, and bleached yarns and cottons are just as possible as dyed ones. We are not considering the similar yarns containing bunches of cotton which are made by two twisting processes, the second twisting being mainly for the purpose of binding in the bunch of cotton more firmly. This extra twisting process is adopted when such yarn is used for warp and is to be handled extensively and is not so generally employed when it is used for filling.

One of the main considerations in

PRODUCING NOVELTY YARN

such as that used is to have the cotton bunches taper off well, inasmuch as this gives a better appearance and also aids in producing firmness, inasmuch as the tapering end of the cotton fibres twists in better with the ground threads. This variety of yarns is often produced on an ordinary spinning frame, in fact, it is probable that much the largest share of it is produced in this manner. One set of rolls is given an intermittent motion through the removal of gear teeth or in some other manner. Between these rolls is placed the roving which forms the bunch in the completed yarn. Naturally the intermittent motion of the rolls feeds the cotton out at regular intervals. Between another set of rolls, which operate regularly, are placed the two ground threads, it being desirable to have the cotton bunch fed out between these two ends as the twist is being inserted, and this method per-

mits the cotton to be bound in more firmly.

The continuous delivery of the ground threads, together with the intermittent delivery of the soft cotton or roving, creates a ply yarn in which bunches of cotton are twisted. The twist in any yarn will run to the finest portions, and this happens very noticeably in yarn of the character described, there being quite a little twist where the ground yarns only appear and very few turns per inch at the point where the cotton bunch is inserted. For this reason the

AMOUNT OF TWIST

which the whole product contains will be much different than that which the ground yarns would contain were they to be twisted separately. The size of the cotton bunch, the character of the result desired, whether there is to be a subsequent twisting process, the kind of yarns used and naturally the yarn sizes, together with certain other features, regulate the number of turns per inch which are necessary or desirable.

In the yarn considered there are approximately ten turns per inch average, and this is what should be considered when twist gears are being considered, although the regular ply portion of the material contains a greater number of turns per inch. In a good many cases novelty yarns, such as that described, can be spun direct upon the bobbins which are used in the weave room, thereby making no other processes necessary and reducing the cost of production quite extensively.

There are certain features which are of interest in connection with the making of high-class drapery and upholstery fabrics. Mills making these materials, as previously stated, are somewhat limited in the amounts of any one style which they can produce. This makes frequent changes in cloth construction necessary in order to obtain a good distribution, especially where high-class merchandise is being produced. Not only are various yarn sizes required, but the colors are usually even more numerous than the variety of yarns. Inasmuch as the orders are rather small, the quantities of any one yarn size used are proportionate, and for this reason it is probably cheaper to purchase yarn than it is to make it. For such yarn to be produced in a wide diversity of sizes a varied organization would be required, with the probabilities of machinery being idle at least a portion of the time.

The grey yarns which are purchased are dyed and often mercerized at the plants where the cloth is woven, and this method of manufacturing permits quite a little variation in the product. Whatever finishing is necessary is also accomplished at the plant where the weaving is done, but inasmuch as dyed yarns are generally used, the finishing of these cloths is a much more simple process than when grey woven cloths are considered. The purchase of yarn makes the problem of manufacture much more complicated than if yarns were manufactured and has much to do with the obtaining of satisfactory profits. To buy yarns which are in good demand and on which the price and profit are high is to curtail to an extent at least the possibility of profits in the manufacture of special fabrics. It is also necessary to produce styles which cannot be made successfully in the larger plants,

Thus it can be depended upon that some of the buyers who have purchased solid color yarn-dyed mercerized drapery and upholstery fabrics will soon procure such materials in the grey state and have them finished with a large reduction in price. This applies only to a small number of fabrics which are purchased in quantities and not for the majority of fabrics which are used for drapery purposes. Purchase of yarn, the extra cost of shipping, dyeing, mercerizing and various other necessary processes, make the cost of the yarn when it reaches the weave room high, and while the loom production is large with a correspondingly low cost in this direction, the total cost is high because of the material which is used. It will be noted that we have in our cost plan given the price of the yarn used. This amount will vary according to the market and to other

selling conditions, but it is approximately correct for the cloth considered. Selling charges are higher than for many other varieties of material, mainly because the quantities sold are not especially large. The rate of profit secured would depend a good deal upon the attractiveness of the result produced, and is not considered upon the production basis which is generally used when large quantities of any ordinary cloth are made.

Without doubt, the success of any concern making special fabrics is more dependent upon a single person than when larger quantities of staple materials are being produced. In a small industry the person who is directing the items of importance has to look after many details which can be relegated to other persons in a large concern. The styles of the cloth are of great importance, as this has an influence on the sales and profits. Experience is necessary as to what methods should be used in best obtaining any certain results. With grey and most of the staple colored lines a certain method of production can be adopted and continuously followed out, but with special fabrics there is more flexibility in the method of production and the adoption of the best method tends to keep down the costs and increase the profits.

Then there are numerous other features which have to be considered by manufacturers producing special cloths, such as the colors to be used in any certain lines, the method by which the cloths are to be sold, the amount of the various styles to be produced, the sale of styles in such a manner as to keep all the machinery in operation. This machinery problem is a very serious one, even with fancy grey cloth makers, for unless the orders are such that a good balanced production is secured between the spinning and weaving machinery, and unless the various kinds of looms are kept steadily employed, the possibilities of good profits are largely curtailed. Because there are more changes in styles and more ability necessary in producing them it is customary for the salary ranges of employes to be higher when such cloths are being produced than for other kinds of cloth making. It is necessary to obtain good operatives and what is more to keep them, if a satisfactory result is to be secured.

One of the fabrics which has never been produced in the domestic market until recently, but for which there has been and is an increasing demand, is tapestry material, which is used for wall decorations. These materials are used to cover up undesirable portions of wall, and in many cases are used because of desirable patterns or colorings. They are produced from dyed yarns and the combination of yarn and weave produces the various effects. Without doubt, the making of large effects in such cloths is one of the most complicated forms of textile manufacture. The placing of the various colors and figures where they will appear best is an art, and makes possible results which would otherwise be considered impractical. Many colors are used in the warp, and the same is true regarding the filling.

Oftentimes the warp has no special pattern, and the method of dressing varies from one side of the cloth to the other, each section being designed especially for the result to be produced. Jacquard looms are used in producing these cloths, and, due to the length of the repeat and the great number of picks in the filling, a

LARGE NUMBER OF CARDS

are necessary for the completion of the pattern. It sometimes happens that the design making and the cards employed alone cost $1,000 or more, and in such instances the production cost is regulated a good deal by the amount of the tapestry which can be sold. When the sale is small, the design cost is large per yard, whereas when quite a distribution is made this item is of much less importance, although it naturally is quite high in any such material.

The illustration we present shows one style of tapestry which is produced in the domestic market, and it is claimed that only one concern does any work of this character. That

there is any at all produced shows that there has been a great deal of progress in the manufacturing ability of domestic producers, and, without doubt, such cloths will be in larger demand with a greater number of sellers producing them in the near future.

YARN AND CLOTH WEIGHTS.

Regarding the yarn and cloth weights, it can be said that few of such materials as that analyzed are sold by the count or weight as are many of the fancy dress goods which have a large distribution. This information is necessary for the manufacturer in order to ascertain the cost of production, but such information is of small importance to the buyer, inasmuch as he is more interested in the style of the cloth and the prices at which he is able to distribute. Sometimes, when a fabric is to be duplicated it is necessary to obtain the various details of manufacture, but in this connection it is well to remember that the yarn sizes will not be the same as when they were purchased or spun.

The processes of mercerization, dyeing and handling are likely to give results somewhat different than when the yarns were originally purchased. In this fabric, the warp yarns are somewhat finer than when purchased, but not to as great an extent as is noted in many of the white mercerized fabrics which are piece finished. An interesting feature regarding the manufacture of this cloth is that, due to the heavy character of the filling and the large number of threads per inch, the contraction in width from reed to cloth is not very great, being in this fabric not quite one inch for the whole fabric. Ordinarily, it is much more than this amount. The method of obtaining the weights is as follows:

5,000 ends ÷ (60/2 × 840) = .1984, weight of warp yarn without take-up.
10% take-up in weaving.
.1984 ÷ .9 = .2204, total weight of warp yarn per yard of woven cloth.

$$\frac{17 \text{ picks} \times 51'' \text{ reed width} \times 36''}{36''} = 867 \text{ yards}$$

of filling per yard of woven cloth.
867 ÷ (3.8 novelty × 840) = .2716, total weight of filling yarn yer yard of woven cloth.
.2204 + .2716 = .4920, total weight per yard.
1.0000 ÷ .4920 = 2.03 yards per pound.

MERCERIZED DRAPERY NOVELTY.

60/2 Am. combed, mercerized and dyed. 5,000 ends.
3.8 novelty yarn; 17 picks per inch.
49 reed, 51" width in reed, 50" finished width.
100 × 17 finished count.

YARNS.

60/2 Am. combed, mercerized and dyed (cost on loom beams) =	77c.
3.8 novelty carded, dyed (cost on quills) =	34c.

CLOTH COST.

5,000 ends 60/2 Am. combed + 10% take-up	= .2204 @ 77c.	=	$ .1697
17 picks 3.8 carded novelty	= .2716 @ 34c.	=	.0923
Weaving			.0272
Expenses			.0152
			$ .3044
Selling			.0122
Mill cost			$ .3166

Yards per pound 2.03.
Retail price $1.25 per yard.

MOCK LENO WEAVE CREPE

At various times we have analyzed and described certain of the crepe fabrics which are sold in large quantities; and because these fabrics appear attractive and are selling well at present, it may be well to present a description of a special crepe which contains features radically different from most of those produced and sold. Manufacturers and sellers of novelty fabrics recognize that profits are obtained through the production of attractive styles and materials which are similar to a certain extent to those in demand, but in which ideas are

developed that are different from what the majority of sellers are offering. When fabrics of this character are developed, it is usually possible to obtain a comparatively

HIGH RATE OF DIVIDENDS,

which is of value in building up a reputation for attractive fabrics that produce returns. Of course, the various fancy fabrics being produced to-day are, many of them, adaptations of the so-called ratiné effects, and crepe grounds contain such ideas as well as other good selling fabrics. Next to the wide range of ratiné styles, crepe fabrics appear to be the leaders, these cloths being used for dresses, waists, and various other uses depending somewhat upon their construction and appearance. Certain of such styles are being printed to-day and are having quite a distribution, while many of them contain silk stripes on which jacquard figures are woven or which in some manner add a certain attractiveness to the finished result. Crepe fabrics have a characteristic softness which is not usual in other materials, and do not show wrinkles in as prominent a manner as some other styles, thereby making them have a certain advantage so far as appearance is concerned.

CLOTH CONSTRUCTION.

Any crepe cloth is usually of a rather low count and would not be considered a very firm construction when compared with the majority of cotton materials. This loose construction is rather necessary, for unless this method of making were adopted there would be no great opportunity for the yarns to contract and produce the crepe effect. In the majority of instances crepe cloths are made with single yarns and few of them of anything like a fine nature. The ordinary cheap crepe materials contain, approximately, yarn which averages about 25-1, though the finer varieties naturally are made from somewhat finer yarns. In the fabrics which are usually produced, the warp yarn is identical or nearly so with ordinary warp of the same size, that is, the standard of twist is the standard which is noted for ordinary warp, namely, about 4.75 times the square root of the yarn size. The crepe effect is produced through the filling yarn and is caused by the introduction of a large amount of extra twist, the standard being anywhere from 6.50 to 9 times the square root of the yarn size, whereas in most ordinary filling the standard of twist is seldom over 3.75 times the square root of the yarn size. In the fabric considered

ONE ITEM OF INTEREST

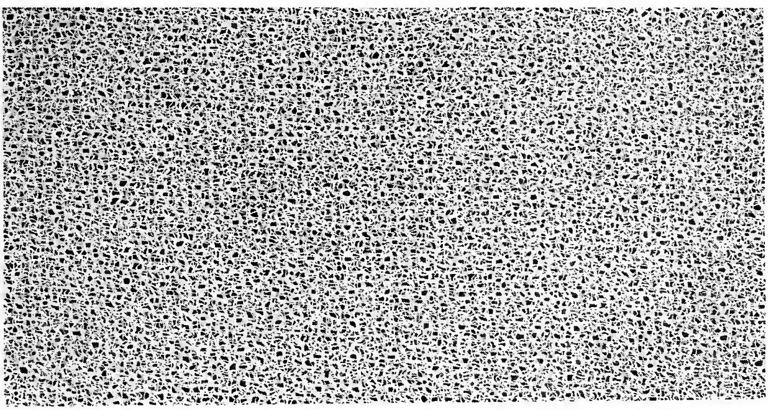
is found in that the yarns, both warp and filling, are of a two-ply character. This method makes it possible for a clearer cloth to be produced, but for the same result, so far as weight is concerned, much finer yarns are necessary. In this cloth there have been used 120-2 warp and filling and both yarns contain the same amount of twist and are identical in every way. Usually the single yarns which are used in making hard twist ply yarns are no different than are ordinarily produced, the hard twist being introduced only when the two-ply result is being made. Such a fabric as that considered would be made much more economically from grey yarns with the finishing being accomplished after the cloth was woven, than it would if it were made from bleached yarns.

BLEACHED YARNS.

In fact, it would be unsatisfactory to handle bleached yarns as fine as are used in this cloth. There are a number of methods of making hard twist two-ply yarns, the best method depending somewhat upon conditions of operation. For filling it is sometimes a good plan to produce fine numbers on an ordinary spinning frame, twisting the material onto filling bobbins, thus having them ready for the loom with no extra processes needed, except the steaming process which is necessary to set the twist and make the yarn possible to handle. For warp a different method must be adopted, as the yarn must be spooled, warped and sized before it can be woven, and inasmuch as the twist inserted is so hard, much care must be exercised or trouble will ensue. Filling is often

handled in much the same manner as warp, being spooled, warped, sized and quilled on a long chain quiller. When this is done no steaming is necessary because the sizing process has eliminated the need for it. In certain cases other methods are also employed, but it is necessary to keep quite a tension on the yarn or else a large shrinkage will occur and part of the yarn effect when the cloth is woven will be lost. When spinning or twisting hard twist two-ply yarn there is often a great deal of trouble in keeping travelers on frame because the hard twist yarn acts very much as a saw and will cut through travelers in a speedy manner, causing many breakages. The breaking of one end is a much more serious matter than it is with ordinary two-ply, because the hard twist makes the yarn very springy and when an end breaks it is likely to cause the breakage of others alongside of it.

It is seldom that any kind of a crepe fabric contains anything but plain weave on the ground cloth, or at least a very simple weave which acts much the same as plain weave does. The reason for this is found in the low construction and in the result desired. Plain weave gives the most strength for the yarn sizes used and is more effective than others might be when the cloth is finished. Another reason why fancy weaves are not used on crepe ground cloths is because they do not appear at all prominent when such a cloth is finished and the effect is largely lost, making the use of such a weave a wasted effort. In some case fancy weaves are used with silk, but for an all-cotton fabric it is practically never noted. In this connection the fabric which we are considering is radically different from an ordinary crepe, for this cloth contains a weave which is not plain. The weave used is ordinarily known as a "mock-leno" weave and we are illustrating it to make the situation more evident. By taking a piece of the fabric and pulling it there will be noted a distinct



Mock Leno Weave Crepe.

SEPARATION OF THREADS,

the warp dividing into threes. This happens because of the weave used. Threads 1-2-3 slip in together, as do 4-5-6 and so on. It will be noted in our analysis we have used a 17 reed with three ends per dent throughout. The same result might as easily be obtained, and in many cases undoubtedly is, with a 34 reed with three ends in one dent and the succeeding dent containing no threads at all. This allows the effect produced to be more prominent and is some-

times used. In an ordinary fabric the use of this weave produces an openwork fabric which is somewhat similar to a leno weave, but in this crepe fabric such an effect is not noticeable and the great shrinkage from grey to finished width covers up largely the weave which has been used, although it makes a result which is very attractive and is not possible through the use of a plain weave. The floating of the warp and filling allows space for the hard twisted yarn to contract much better than if the weave was entirely plain and the crinkled appearance makes the cloth look as if novelty yarn of a peculiar nature had been used.

PRODUCING CREPE EFFECTS.

There are three distinct types of crepe cloths: First, that class of materials which is produced largely from grey yarn, usually containing hard twist filling alone, but in special instances it contains hard twist warp to a greater or less extent, to which class the fabric analyzed belongs. Second, the fabrics that are produced from bleached and dyed yarns, which contain hard twist usually in the filling, but in very few cases in the warp. Either of these two classes of fabrics mentioned may be woven on a box loom which produces a regular crepe effect, or on a regular loom with one twist in the filling producing a wavy effect. A third class of fabric, which many consider as crepe, is that class of materials produced through the mercerization process. As is usually well known, the application of caustic soda to cotton yarns or cloth will cause them to shrink approximately 25 per cent. If this shrinkage is not allowed and the yarn or cloth is held out to approximately its original width, the cotton fibres which compose the material seem to swell out and become more nearly round, thus reflecting the light and producing a lustrous effect. If no tension is employed, and the fabric or yarn is immersed, a large shrinkage will take place, but no lustre will be noted. This is the method which is adopted in producing the crepe fabrics which are mercerized. In most cases, these crepe styles appear in the form of stripes and are obtained through the methods by which the result is produced. Caustic soda is applied to the material in various stripes and the cloth shrinks where this solution is applied, while the other portion of the cloth will crinkle up, causing a wavy appearance and producing what many have been inclined to designate as a crepe weave, though it is not theoretically of this character. There are various combinations and styles in the several lines of crepe and often one style is mistaken for another by those not experienced in production. Not only is this true, but it often happens that mills manufacturing crepes will produce fabrics by a method which is not the most economical, that is, a mill making bleached and dyed yarn fabrics will produce styles which could be better obtained through the grey yarn method.

INTERESTING FEATURES.

An ordinary crepe fabric seldom shrinks more than 25 per cent, that is, for a 36-inch grey cloth at least a 27-inch finished cloth will be produced, while in most lines the shrinkage is not quite so great as that named. For the fabric analyzed the shrinkage in width from grey to finished cloth is approximately 40 per cent, thus being much greater than for an ordinary crepe fabric. In addition to the shrinkage in width there is a shrinkage in length of from 20 per cent to 25 per cent. This gives a resulting fabric which is not possible to obtain when most cloths are considered and is only possible through the use of hard twist warp and filling yarns. This loss is a serious item in many ways and will be mentioned further in regard to the cost of production. It might be wondered just what happens to the selvages under these circumstances, but it will be found that the selvage ends are not crowded very closely and that they shrink perceptibly, though not in the large crinkles noted in the body of the warp. For this reason, the selvages are somewhat longer than the main portion of the fabric

and contain a more or less wavy effect so as to take up the same amount in length as the main part of the fabric. The fabric, due to its great shrinkage, has to be produced on a very wide loom and inasmuch as there are very few of such looms in use in the domestic market in mills which are capable of making novelty constructions such as that considered, it is very likely that the

PROFIT PER YARD TO THE MILL

is quite high, much higher than it would be were the cloth being produced in large quantities and were it not of so radically different a nature from most materials. Due to the loom width, the picks per minute are not as high as for a narrower loom, thus causing a rather low production and increasing the cost. So far as the weaving operation is concerned, there is nothing especially intricate in this direction, the effect being produced through the character of the yarns, the simple weave and the finishing employed. The cloth in the grey appears very similar to many of the low constructed wide voile fabrics which were so common a year or more ago, though it must be said the result, when finished, is not at all like the voiles used.

PRICES AND COSTS.

There are many interesting features regarding the cost of production and the selling prices for the cloth considered. We have given the cost of making the grey cloth in a large economical mill which would be likely to produce fancy cloths of this character. It will be noted that the mill cost in the grey is approximately 21½ cents per yard. The selling price depends a good deal upon circumstances and on the price which the fabric can be disposed of to other sellers. It is unlikely that it was sold for less than 25 cents per yard and possibly a higher price was obtained. Possibly the item of greatest importance to the converter is in regard to the shrinkage of the cloth when finished. As previously stated, this fabric shrinks in length anywhere from 20 to 25 per cent in the finishing process. Should this cloth have cost 25 cents in the grey state, this shrinking feature alone would add almost 10 cents per yard to the grey cost, without considering the various finishing charges at all, which naturally would be high because of the special character of the cloth and the fact that it is so wide in the grey state. Without doubt this cloth actually costs the converter 40 cents or over, not taking into consideration at all the various expenses or profits which are encountered in selling such a high class novelty. Under these circumstances the retail price of $1.25 a yard does not seem especially high when compared with many of the all-cotton fabrics on which the retail price is at least three times the cost of the cloth in a finished state. Much the same condition exists on the mercerized crepes being sold as are noted on the fabric under consideration, for on these cloths the finishers demand a 25 per cent working loss, though in a number of cases the actual loss does not amount to any more than 18 or 20 per cent. When it is considered that there are quite a number of crepe fabrics, probably the majority, in which there is a greater or less stretch in the yardage secured from the finisher, a decided loss on these fabrics is an item which must be carefully watched or else the profits which are estimated will be eliminated.

GREY AND FINISHED CLOTHS.

When the grey and finished cloths are compared, the first item which is noticeable is the shrinkage in width namely from 65 to 39 inches. The next is in the cloth count. In the grey state the count on the ground fabric is about 52 x 52, while in the finished state the count is about 88 x 68. The increase in the warp count is brought about through the shrinkage in width, while the increase in the filling count is brought about through the shrinkage in length. Another difference, which will be noted, is that the material appears something like a voile with an open work weave when it is in the grey state, and when it is finished there is neither any weave apparent nor any prominent voile effect, the last

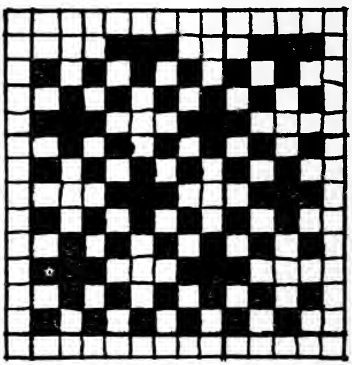
feature being entirely eliminated through the shrinkage of the yarn. Another interesting feature which of course is not so apparent, but which is nevertheless of interest, is the weight of the cloth in the grey and finished state. Most ordinary grey woven fabrics are lighter when finished than they are when woven. Some of the items in connection with this are as follows: A cotton yarn in the bleaching process will lose about 6 or 7 per cent in weight. In addition to this shrinkage there is a loss occasioned by the waste of size applied to the warp to make weaving operations more practical. For ordinary cloth the warp will contain from 5 to 7½ per cent of size, that is in domestic materials, though there are many cases where more size is applied. Under these conditions most fabrics will average to lose in weight from 3 to 4 per cent due to the loss of the warp in size. Altogether, this total loss will amount to approximately 10 per cent, there being a greater or less loss due to the handling and singeing.

FOR A DYED FABRIC

the dyestuff will create an additional weight, but in no case in an ordinary cloth does it anywhere near approach the other losses. A fabric which contains a dark dyestuff may weigh about 2 per cent more, due to the dyeing process, but for light shades the additional percentage will decrease to almost a negligible quantity. Under these circumstances it can be stated that an ordinary grey fabric will lose in weight in finishing from 7 to 10 per cent. This is in opposition to the general opinion and the statements of many who have never investigated the situation and know very little regarding the theory of manufacturing and finishing. These various losses are ordinary ones and do not include the losses due to stretching, which in some instances have been known to be as high as 15 per cent, though in most cases 5 per cent stretch is more nearly the amount which would be noted. On the fabric considered it will readily be noted that there is a much different condition existing, for while the grey yards per pound are 6.38, the finished yards per pound are in the vicinity of 5.25, this cloth being much heavier when finished than it is when grey, even though the yarns actually lose approximately 10 per cent in the various finishing processes.

YARNS AND WEIGHTS.

There is no necessity for the cloth weight finished to be obtained except as a matter of interest in connection with the shrinkages, but the cloth is sold in the grey state and it is usually sold on the construction and weight. For this reason, we are giving the method of obtaining the weights through the yarn sizes and take-up. When such a fabric has to be consid-



The Weave.

ered in its finished state, it is necessary to use a great deal of care in obtaining the yarn sizes and various other items of manufacturing. Unless this is done the correct results will not be obtained. In twisting, the excess twist will make the yarn contract and two ends of 120-2 will not produce a yarn which sizes the same as 60-1, but it will be coarser than the number named. The 10 per cent loss must also be considered due to the bleaching and other processes, so that there is opportunity, for those not experienced, to have the yarn sizes vary as much as 15 or 20 per cent from what they actually should be. In giving the details for the manufacture of the yarns we have given

the cotton staple and other items, which would be noted in the normal mill. Some manufacturers are able to produce the size of yarn considered out of shorter cotton than what we have used, while it is probable that in other cases somewhat longer cotton is necessary. This depends upon the mill equipment and upon other manufacturing details. One item which must be considered when comparing the cost of making such yarn with the selling price is that the production of fine yarn is a comparatively small amount per spindle, and in order to obtain the same profit per spindle as on coarser numbers there must be a much greater relative profit per pound. Five cents per pound profit on 120-1 is nowhere near as great a profit as one cent per pound upon 30-1 and must be considered when profits and selling prices are treated in a reasonable manner. The weights of the yarn used and the weight of the grey cloth is as follows:

120/2 hard twist contains 46,150 yards per pound instead of 50,400.
3,517 ends ÷ 46,150 = .0762, warp weight without take-up (grey cloth).
6% take-up in weaving.
.0762 ÷ .94 = .0811, total warp weight per woven yard (grey cloth).

$$\frac{52 \text{ picks} \times 67'' \text{ reed width} \times 36''}{36''} = 3{,}484 \text{ yds.}$$

of filling per yard of grey cloth.
3,484 ÷ 46,150 = .0755, total filling weight per woven yard (grey cloth).
.0811 + .0755 = .1566, total weight per yard.
1.0000 ÷ .1566 = 6.38 yards per lb. (grey).

PATTERN.

120/2 Sea Island combed hard twist $\frac{2}{40}$ 3,357 $\frac{2}{40}$ = 3,517 total ends.
120/2 Sea Island combed hard twist, 52 picks, grey.
17 reed; 67" reed width; 65" grey width; 39" finished width.
52 × 52 grey count; 88 × 68 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
120/2 Sea Isl'd combed H. T.; 1¾" sta.; 24 hank dou. rov..	30c.	48c.	22½c.	= $1.00½

Warp and filling identical.
Yards per pound, 46,150 (due to contraction).

CLOTH COST.

3,517 ends 120/2 Sea Island combed H. T. + 6% take-up	= .0811	@ $1.00½ =	$ .0815
52 picks 120/2 Sea Island combed H. T. filling	= .0755	@ $1.00½ =	.0759
Weaving			.0338
Expenses			.0184
			$ .2096
Selling (grey)			.0040
Mill cost (grey)			$ .2136

Yards per pound 6.38 (grey).
Retail price $1.25 per yard.

UNIQUE LENO RATINE

Practically all the sellers who handle fancy fabrics of any character are now offering their merchandise for another season. In the various ranges of fabrics which have been shown, ratinés, or fabrics which many would classify under this heading, are without doubt being shown in greatest quantities. The quality of the above-mentioned fabric, together with the selling price, will vary from a very low figure to a very high price, and there is a great deal of discussion heard as to the relative values which are being purchased. Without any question, the radical nature of the fabric has made it impossible for many buyers to purchase with any degree of certainty, and while they are usually able to distribute the fabrics taken at a profit, nevertheless it will be readily recognized that buyers are less

LIKELY TO OBTAIN GOOD VALUES

than they have been in other seasons. This above result is caused through the fact that these ratiné fabrics are

produced in so many different methods and in such widely varying constructions, making it comparatively impossible for a purchaser to compare them with other styles or with fabrics which have been handled previously. Many of these so-called ratine fabrics are almost identical with certain of the toweling fabrics regularly produced and are made on a terry cloth loom.

Another type of fabric is woven on a loom that produces somewhat similar results to the terry motion, but the loops are produced in a different manner by wires which are inserted and which hold up the yarn as the cloth is being woven. This process is very similar to that employed in making many styles of carpets. On both the above-mentioned methods jacquard patterns are employed, though in the first process the back of the cloth is the reverse of the face. Various adaptations of these two processes have also been employed. In addition to the processes mentioned, there is a wide variety of fabrics now being offered which are produced from novelty yarns. Inasmuch as novelty yarns can be produced in an unlimited number, it naturally makes it possible to have a wide variety of woven fabrics produced from them. Of course, the various kinds of loop yarns produce results which are more nearly identical to those resulting from the terry motion, but the entire range of fabrics are generally known as ratiné. In addition to the methods we have mentioned as being used in making the fabrics under discussion,

A FABRIC HAS APPEARED,

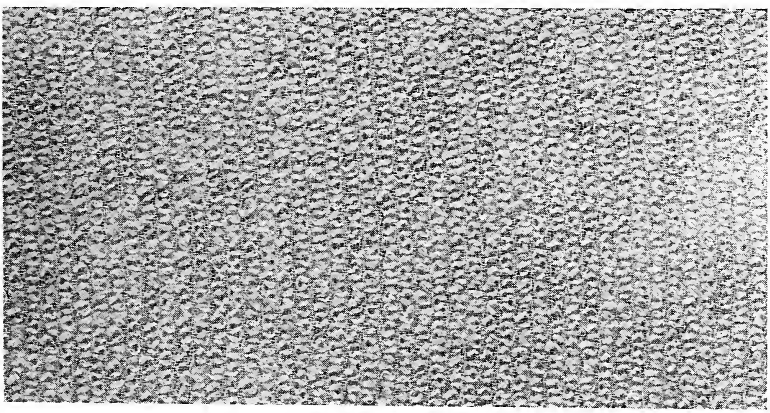
which, while having the general characteristics noted in many ratiné fabrics, is, however, produced by an entirely different method and one which would by many be considered rather impossible. This method, of which the fabric we have analyzed is a good example, is through the use of the ordinary leno motion. The crossing yarn is run very loosely and the method of construction aids in producing the result. In many cases, this fabric would be considered more desirable than certain of the original cloths, because the loops are not so prominent, the fabric is more stable and the effect is practically as desirable from a selling standpoint. These various lines of cloths are used for dresses, waists, vestings, hats, trimmings, ties, and any number of other articles, even being seen in draperies, coverings and other radically different articles.

As previously stated, a leno weave is responsible for a large portion of the effect noted in the fabric analyzed. This leno weave has a crossing thread which crosses back and forth over three ground threads, being woven in a loose manner, in order to give the roughness desirable to the fabric. To cause an irregular appearance to the loose yarn there are two doups used in making the cloth; that is, there are two different motions to the crossing threads. Both of the motions are identical, but the second operates on a different pick than the first. Inasmuch as the crossing thread works in combination with three ground threads, the body of the warp is drawn in the reed three ends per dent. The crossing threads do not operate over every three threads, but rather over every second three threads; that is, the first crossing thread operates over threads 1-2-3, while crossing thread No. 2 operates over threads 7-8-9. The illustration of the weave should make this entirely clear. We are not presenting the entire weave, because it repeats on twelve-ground threads and picks instead of the six which we have used. The reason why

THE REPEAT OF THE WEAVE

is as large as it is, is because there is a regular ground weave all over the fabric. This weave is a regular four-harness twill with no changes made because of the leno threads. This will be noted in the illustration for the warp, which is of a mottled character, operating for two picks on the face and then reversing for two picks on the back of the fabric. One of the items of importance is that the crossing thread is on the face every time it changes its position. This method holds the yarn in place and keeps the threads in their correct positions.

To make the result effective there has been used in the cloth considered a comparatively fine yarn for the ground of the cloth with a rather coarse yarn for the crossing threads. This heavy yarn has a very small amount of twist inserted, for this gives the fabric a soft appearance and, in addition, is of value because the leno or crossing yarn has been mercerized before the weaving operation. To give as good an appearance as possible to this yarn, it is made from combed stock, though of about as short character as can be satisfactorily combed. The ground yarns are made from slightly better stock than would be used for plain cloth containing the same sizes of yarn. This is not absolutely necessary, but will often be found desirable in such a fabric as that considered, because the increase in production more than offsets the extra price which is noted for the better cotton. In a fabric of this character, the yarns form a comparatively small portion of the total cost, oftentimes the percentage of labor in the fabric amounting to about 75 per cent of the total cost of making. It will thus be seen that the use of a cotton wherein a small percentage of increase in the weave room production can be secured is of large advantage. The best method to produce such a fabric as that considered is to use grey yarns, with a mercerized leno yarn, and then bleach the fabric in the piece after it has been woven. The mercerization of the yarn and the price which has been given for it are the ones which would be noted were it planned to have another party accomplish this work, a condition which is by far the most common, inasmuch as grey cloth mills very seldom have any finishing apparatus. It is usually good policy to use as coarse a reed as possible in making fabrics of this character, because this allows much easier crossings for the leno threads, and the heavy leno yarn is less likely to be broken than if a fine reed were used. In most fabrics of this character it is possible for a weaver to run only one loom. This is necessary, because the doups are continually breaking, and as the material is comparatively expensive it is not a good policy to allow the leno yarn to stop operating for even a few picks, as it makes a second.



The Leno Ratiné Fabric Described.

COSTS AND SELLING PRICES.

Possibly the most interesting item regarding the fabric considered is that which concerns the cost of manufacturing and the price which is being obtained at retail. Allowing reason-

able items in our analysis we find that for the width of cloth considered it should not cost over 20 cents for a mill to produce the material; in fact, it is likely that it could be produced for a smaller amount in quite a number of instances. These fabrics are in good demand to-day, and allowing a high mill profit, namely 15 per cent, the mill's selling price should not be over 22 cents. Under such conditions this fabric should be sold by the retailer at 50 cents per yard and have the various sellers obtain a rate of profit satisfactory for the radical nature of the fabric. That this has not been done is readily recognized, inasmuch as the cloth is not selling for 50 cents per yard at retail, but rather is being offered for $1.49. It would seem as if it were possible for converters to develop a fabric similar to the one analyzed, but in a slightly narrower width, so that it could be sold at no more than 39 cents per yard and allow a very good profit to the various sellers. We believe this would have occurred if this fabric had been produced earlier than it was, but there is a tendency among manufacturers to avoid novelty materials of this character at the present time, for they believe the sale will shortly decline. This price of $1.49 per yard shows that someone has obtained a very large profit, and very likely it is not the manufacturer.

THE RETAILER UNDOUBTEDLY

is obtaining quite a little extra profit, but it does not seem possible that he is obtaining anything like the entire profit which this fabric shows. There are very many materials being sold on which the retail price is at least three times the cost of the goods in a finished state, but it is seldom that the retail price is from six to seven times the cost of the goods in a finished state, as is noted on this cloth. The result illustrates very clearly what is likely to happen when retailers and others do not give enough consideration to the fabrics being produced in the market and do not recognize the actual cloth values in any way. Possibly the retailer can obtain $1.49 per yard for this material, largely because the consumer is often foolish where styles are being considered, but there should be no legitimate reason for such a thing occurring and probably retailers, even previous sellers, are being as badly deceived regarding value as the consumer is.

It may be that this fabric was imported, yet it was not claimed that such was the case, but if it was imported, it shows that the purchaser has absolutely no idea regarding value and that the material could have been produced in the domestic market so as to be sold with large profit at a much more reasonable price. Many times fabric importers do not give enough consideration to the lines of high-class novelties which some of the domestic

SELLERS ARE DEVELOPING

These buyers will make trips to foreign markets and purchase a certain amount of cloth which, with the duty, makes their purchases cost quite high amounts, whereas if they had used half as much effort in examining the various lines in the domestic market they could have obtained just as great variety and oftentimes the identical fabric at a very much lower price. It is often the practice to purchase all the fabrics from a single seller in the domestic market, and while this has its advantages, nevertheless it does certainly curtail the variety which is obtainable and oftentimes eliminates fabrics which would help in enlarging the distribution of the purchaser. There have been more instances of purchasers being fooled regarding values the present season than there ever has been in the past, and while there always is a certain amount of this taking place, nevertheless the styles being purchased and certain other features in the situation tend to indicate that consumers will not continually be as easily deceived regarding fabrics as they have been the present summer, and sellers may not be able to dispose of their merchandise at the enormous advances which many of them expect to obtain.

When such a fabric as the one considered has to be produced by a mill not acquainted with the manufacture of it, there must be a great deal of

consideration given to the analysis of the fabric before any definite price is named for any large quantity. In the first place, unless the fabric is duplicated within a reasonable degree of accuracy, the result obtained will not be identical with the fabric being imitated.

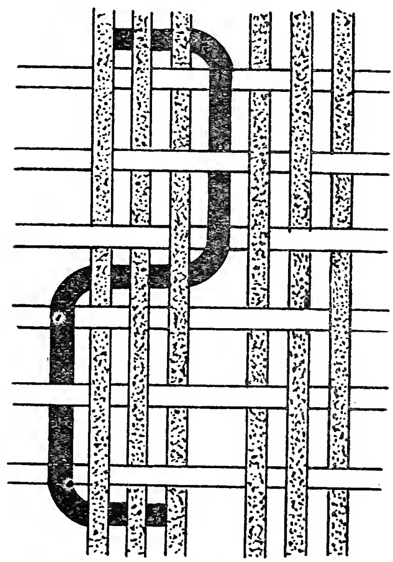
The sizes of the ground yarns, both warp and filling, can be obtained in a comparatively easy manner, but such yarns are somewhat finer in the finished cloth than they are when they are used in producing the grey material. This, however, is not of great importance in a fabric of the character described, but is of interest in the result. The same condition applies to the leno yarn and, while the losses are likely to be somewhat greater on this yarn, due to the soft twist which has been used and to the mercerization process, the finer size in the finished cloth does not affect the result as much as the take-up on the yarn.

THE ENORMOUS TAKE-UP.

Not only does the take-up affect the appearance of the cloth, but it also has much to do with the cost of the material which is used in producing it. It will be noted from our analysis that there has been a take-up on the leno yarn of practically 68 per cent, or, in other words, it requires about three yards of yarn to weave one yard of cloth. Many ordinary leno fabrics are woven with a take-up of from 20 to 30 per cent, and a mere estimate of the actual take-up in weaving the cloth considered would be likely to fall far short of what the take-up would actually be, thus giving a much smaller weight of yarn to produce the cloth and a lower cost than should be noted. This fabric illustrates very well why it is not a good plan to size yarn as it stands in the finished cloth without considering at all the take-up in weaving. This yarn was 28-2 when used, whereas, if such a method of sizing the yarn had been adopted in assessing duties, the result obtained would be applied to 10-2 yarn, rather than 30-2, with a lower rate of duty than actually should be noted. Of course, this would make very little difference in a fabric where the ground yarn is as fine as it is in this cloth, with the leno yarn as coarse as that used, but the yarn sizes are not always relatively the same as they are in the cloth analyzed, and fine two-ply yarn is sometimes noted for the crossing threads. It is this large take-up in crossing yarn which is mainly responsible for the ratiné or towelling effect.

THIS FABRIC IS NOT STRETCHED

like many of the materials which are being sold to-day, but instead, it



Illustrating Mottled Appearance of Warp.

shrinks a slight amount in finishing, which gives a better effect, yet which makes a few more picks in the cloth than when it is woven with a correspondingly fewer number of yards returned. The shrinkage in width is somewhat greater than for most ordinary cloths, as this is desirable, inasmuch as it creates somewhat more prominent loops. The shrinkage in length affects the cost to the purchaser, but not in very large amounts and not anywhere near so radically as is noted on some other fabrics which are being

handled in quantities to-day. Making the fabric in the manner described is of a certain amount of advantage, because the back of the cloth is smooth. This does not occur when novelty yarns are used, neither does it occur in a great many of the ordinary terry cloths. The crossing back and forth and weaving in of the leno threads makes a very firm fabric with a comparatively small number of threads and picks per inch and also when quite fine yarns are used for the ground cloth. Such a cloth construction would not be permissible in producing this character of fabric as ordinarily produced, for the threads would slip and the result would not be desirable.

Practically none of the terry cloths of this character are made from yarns as fine as are used in the fabric considered, and if they were the heavy yarns would not be bound in sufficiently. The fabric described is one of the lightest appearing ratinés which has been produced and the whole effect is not only a very good imitation of the novelty yarn or terry cloth styles, but it is also very much like an ordinary crepe, due to the light and irregular character of the cloth. The method of obtaining the weight of the yarns and the cloth is as follows:

2,658 ends ÷ (60/1 × 840) = .0527, weight of fine warp without take-up.
6% take-up in weaving.
.0527 ÷ .94 = .0561, total weight of fine warp per yard of woven cloth.
403 ends ÷ (28/2 × 840) = .0342, weight of heavy warp without take-up.
68% take-up in weaving.
.0342 ÷ .32 = .1068, total weight of heavy warp per yard of woven cloth.

$$\frac{64 \text{ picks} \times 44 \text{ reed width} \times 36''}{36''} = 2{,}816 \text{ yds.}$$

of filling per yard of cloth.
2,816 ÷ (65/1 × 840) = .0516, total weight of filling per yard of woven cloth
.0561 + .1068 + .0516 = .2145, total weight.
1.0000 ÷ .2145 = 4.66 yards per lb. (grey).

PATTERN.

60/1 Am. combed warp	2/60	6	2/60	=	2,658
28/2 Am. combed warp merc.		1		=	403
		$\underbrace{\qquad}_{403\times}$			3,061 total ends.

65/1 Am. combed filling; 64 picks.
19 reed; 44" width in reed; 37½"-38" finished width.
79 × 65 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting and merc.	
60/1 Am. combed; 1⅜" staple; 12 hank dou. rov.,	22½c.	19¾c.		= 42¼c.
28/2 Am. combed; 1⅛" staple; 5¾ hank dou. rov.,	15½c.	9½c.	6½c.	= 31½c.
65/1 Am. combed; 1 5-16" sta.; 16 hank dou. rov.,	21c.	18c.		= 39c.

COST.

2,658 ends 60/1 Am. combed warp + 6% take-up	= .0561 @ 42¼c.	=	$ .0237
403 ends 28/2 Am. combed warp + 68% take-up	= .1068 @ 31½c.	=	.0338
64 picks 65/1 Am. combed filling	= .0516 @ 39c.	=	.0202
Weaving			.0935
Expenses			.0223
			$ .1935
Selling (grey)			.0035
			$ .1970
Mill profit (15% upon fair capitalization)			.0220
Mill selling price			$ .2190
Finishing			.0175
Converter's Expenses			.0325
Total cost to converter			$ .2690
Selling price to retailer ought not to be over			.3250
Retail price ought to be less than			.5000

Actual retail price $1.49 per yard.
Yards per pound (grey) 4.66.

SPECIAL WEAVE CREPE

We have previously analyzed and described certain varieties of crepe fabrics, but inasmuch as another effect, which seems more or less desirable, has been developed, it may be of service to manufacturers to describe the material in some detail. The whole fancy cotton cloth industry is built up on ideas, and the developing of new ones or the changing of old ones over to a slightly different form is mainly responsible for most of the satisfactory profits received, and the lack of these same ideas has a great deal of influence in bringing about losses and ultimate failures.

Everyone knows that novelty yarn fabrics have been very desirable and that large profits have been secured in their manufacture and sale, often when the cloths contained very little wearing value. Many expect that the present season will see the height of the demand for such cloths, and that another year they will be much less salable, especially the fabrics of unsatisfactory construction. This condition is recognized by the best sellers and they are avoiding such merchandise as much as possible, although naturally they have to handle a certain amount in order to satisfy buyers and keep their lines as wide in variety as possible. These foregoing facts are likely to have a great influence on the sale of crepe cloths.

For one thing, crepes have not been in demand for so long a time as novelty yarn cloths, thus making their sale an increasing one, while that of novelty cloths is a decreasing one. Then the extended use of novelty yarn materials, which are mostly of a very heavy character, is very likely to create an aversion to such goods, making lighter fabrics, of which most crepes are very good examples, in especially good demand. At present the best selling cloths of a fancy character are crepes which have decorations of a novelty yarn character, the fabric thus constructed obtaining whatever advantages there are in the sale of these two cloths.

Few realize the great variety of construction and adaptations which are desirable and probably necessary in the distribution of any such novelty cloths as voiles, ratinés or crepes, but it can be said that the lines of practically every seller of such goods will vary to a certain extent and while general ideas are often adopted, the cloth construction, pattern or cloth results finished show a great many differences. This is done not only because there is a large demand for variety, but also because of the set prices which are in vogue, and other features. Then it is customary to produce in cheap materials the same ideas which are selling well in the more expensive cloths and the lowering of quality often creates many different effects, the same thing being true regarding fabrics which are made in the more expensive grades.

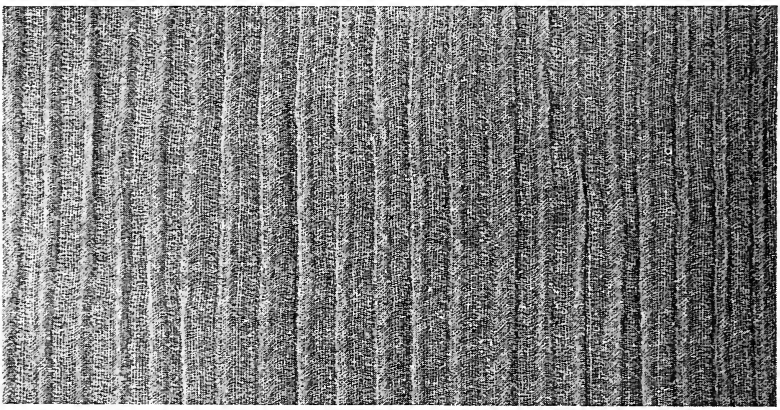
When any ground fabric is in demand, manufacturers can change the construction and readapt styles almost without number. This is where the value of an idea like that considered is of interest. The cloth is a crepe in many respects, still it has a face appearance something similar to a voile, due to the use of good two-ply yarn, and, in addition, has a noticeable wave appearance which is radically different from that of ordinary crepes, either box loom or regular. In fact, the result is something like a Bedford cord of an extremely light crepe construction, with the stuffer threads omitted.

As is quite well known, crepe cloths are a special material, not only in regard to the yarns used in their making, but also as to the finishing processes. Crepe constructions might be said to be generally of a very low character with a comparatively few threads and picks per inch. This method of production is adopted to allow for the shrinkage in finishing which gives the cloth the result generally noted. Of course, certain crepes are made with quite a firm construction, but it is not the usual method, and when such a course is used, the shrinkage and appearance is not that so often noted. Ordinary crepes of a wavy character can be woven on an ordinary loom with only one twist in the filling. Most crepes, however, are woven on box looms, at

least those which are sold at the higher prices. Sometimes a pick and pick loom is used where a single pick of one twist of filling is inserted and then another pick of filling is used with twist inserted in the opposite direction from that previously used.

Box loom crepes are also made in great quantities where there are two picks of each kind of twisted yarn inserted, this being caused by the fact that most mills are not in positions to use a single pick of any filling. A comparatively few crepes have been made where over two picks of a certain kind of twist are used in succession, but this results in special effects which are not usually especially desirable. The cloth under discussion was produced on a pick and pick loom, this being necessary because only a single pick of hard twist filling is inserted when this filling is used. Although in the cloth the introduction of these hard twist picks of 60-1 is not regular, it is comparatively so, and the picks will average to be two of 150-2 and one of 60-1 hard twist. Under this condition out of the 90 picks per inch, which the cloth contains, 60 of them will be of the two-ply yarn, while 30 of them will be of a hard twist character.

There are a number of features which are worthy of mention in connection with the yarns used in the fabric analyzed. It is necessary for the filling yarn to be twisted to a much greater extent than is ordinarily the case, if there is a satisfactory amount of contraction, which contraction produces the crepe effect so often noted. This shrinkage occurs when the fabric is finished and not during or immediately after the weaving operation. In fact, on many styles of crepe fabrics the contraction in weaving is not nearly so great as it is for many ordinary fabrics. The standard of twist which is inserted in yarn of this character will vary quite a little, but it will run from 6½ to as high as 9 or even more times the square root of the yarn number in turns per inch. The usual standard is about 7½ to 8.



Special Wave Crepe.

One interesting feature, which is not apparent to most mill men until they attempt to make hard twist filling, is that there is quite a large contraction, the amount varying somewhat, due to the amount of twist inserted in the spinning operation. Thus, to have the drafts satisfactory in the spinning and the roving of the correct size to obtain any yarn size, the roving has to be finer than it otherwise would be. In many cases there is a contraction of at least 10 per cent when the yarn is spinning, making it necessary to have the rov-

ing correspondingly finer. Hard twist yarn also has to be treated in order to make it satisfactory to weave. The excessive amount of twist makes the yarn very springy, and to weave as it comes from the spinning frame would result in the cloth being full of small loops and probably being entirely seconds.

To overcome this difficulty, the yarn has to be steamed or handled in some such manner to set the twist and eliminate any springy tendency. Yarn is usually steamed on the filling bobbins and because most bobbins are likely to contain oil which has soaked into them or varnish or in some other manner to give out undesirable elements when under high temperatures, it is necessary to use bobbins which have been specially treated so that the yarn will not be likely to absorb any foreign matter. With some mills this is not so necessary as in others, but satisfactory results practically always make it imperative. One of the interesting features in connection with hard twist yarn is regarding the cost of production. In many hard twist yarns it is possible to use a somewhat shorter staple than if ordinary yarn was to be produced.

The change in this direction, however, is very slight, and in many cases not feasible for a manufacturer to adopt, but the quality of the results has much to do with this problem. One reason why shorter cotton can be used is because of the irregular results noted in crepe fabrics. Of course a shorter staple does help slightly in reducing the cost of production, but it is of very small importance when the increased cost is considered due to slower production. As the turns per inch in any yarn increase the production will decrease, for the speed of the spindle is approximately stable.

As the production decreases the labor and various other expense items increase, for the production per spindle is the item of greatest importance in the making of accurate cost estimates. It is seldom that any satisfactory hard twist yarn costs less than twice as much as for the same size of yarn of similar ordinary character, that is, warp yarn. Each mill has problems in this direction which make results somewhat different, but it is one of the items of importance and should never be overlooked in any way. In connection with the yarns used in this cloth it may be well to state a few facts regarding the fine two-ply yarn which has been used.

A great many have a mistaken idea regarding the cost of yarns as the sizes increase. This is not true and is explained as follows: As an illustration 30-1 is produced over six times as fast as 100-1, although 100-1 is only three and one-third times as fine a size. This is mainly because the turns in any yarn are not regulated by the size, but rather by the square root of the size. Due to the great reduction in production the cost of the yarn increases by approximately the same ratio as the production decreases. This is true generally when all yarns produced on a spinning frame are being compared, but when yarn sizes become so fine that it is necessary to produce them on a mule the difference is even more radical.

The figures we have mentioned apply to frame yarns, but for the 150-2 a much greater reduction in production, with a radical increase in cost of production is noted. Of course, frame yarns are being successfully made up to about 125-1, but above this point mules are found necessary. The minute a change is made from frame to mule for approximately the same kind of yarn, there is a decided jump in the cost of production. We have considered this feature in our fabric cost estimates. The same thing is more or less true regarding the cost of the twisting process because the number of turns per inch does not increase according to the yarn size.

Crepe cloth construction is usually pretty well known, but its adaptation in such a manner as that in the cloth under discussion is seldom seen. In the first place the face of the cloth may be said to be composed entirely of 150-2 yarn with a count of about 74 x 60 in the finished state. On the back of the cloth and bound in at regular intervals across the fabric is the hard twist 60-1 filling. This yarn floats on the back much the same as

in an ordinary Bedford cord, but naturally does not become face yarn at all, as in the cloth mentioned. When the fabric is finished this yarn, which is loose on the back, contracts and forces up the plain woven face material, thus creating waves or tucks as noted. One item in regard to this fabric is that it probably would be a much more satisfactory method to weave the cloth face down in the loom. This makes it necessary for the loom to lift much less yarn and saves in power and is likely to result in a better appearing fabric.

This item of weaving cloths face down is one which is not always considered as seriously by manufacturers as should be done, for while the power saved is often slight, it is true that a much better appearing fabric can often be obtained. The shrinkage in width in this cloth is much more radical than for most crepes, for in the majority of instances there is less than a 25 per cent shrinkage, while this cloth shrinks more than 30 per cent. There are certain objections which might be offered to a fabric of this character, the main one being that the loose ends on the back are likely to catch on any substance or projection which they are brought in contact with. In a good many cases this is of comparatively little importance and does not affect the value of the idea. Neither does it make the method undesirable in other fabrics. Such a cloth as the one considered, but made in stripes or checks of an attractive pattern would undoubtedly be responsible for a very satisfactory profit.

The fabric considered is an imported article and in this connection it may be well to state a few facts. Many domestic mills are organized to produce large quantities of staple and semi-staple cloths, and fancy mills have been patterned after the same general idea. This makes it necessary for a manufacturer to obtain large contracts and get out cloth at comparatively low prices, but the method is of great disadvantage so far as fabric variety is concerned. With the great increase in high class cotton fabric sale domestic manufacturers are at a disadvantage, for they behold their number of styles increasing rapidly, together with the cost of production, and it is creating so much detail that the large organizations are not especially capable of handling them. It is absolutely certain that most of the manufacturers in the domestic market cannot broaden out very much more than they have done without creating a great deal of trouble for themselves.

The foreign manufacturer operates in a much different manner. He produces much smaller quantities of the various styles, and while this does make the cost of manufacturing comparatively high, it offers opportunity for the display of individual effort which is not possible in any large way in the domestic market. It might be possible to sell 50 or 100 pieces of a certain fabric at a price which would return a large dividend, but because of its high-class character a buyer might not desire to purchase any large amount. Such fabrics are not suitable for most domestic manufacturers and partly explains why we have had importations of foreign merchandise. It is not so largely a question of price as it is a question of variety and the size of orders which can be handled satisfactorily by buyers. With a jobber handling merchandise large orders are, of course, divided into many parts, but there is a very evident tendency to distribute goods direct to the retailer in fancy lines, and it is certain that much more of it will have to be done if domestic sellers compete with handlers of foreign merchandise, a large majority of whom adopt such methods.

There is comparatively little interest in regard to the finishing of this fabric. Of course it cannot be handled by the majority of finishers mainly because it is so wide. It is piece-dyed and the steaming or boiling is responsible for the contraction and crepe effect. Comparatively few crepe fabrics are produced from bleached and dyed yarns. The reason for this is because the excessive amount of handling and the character of the yarn not only make the cost of production high, but develop many difficulties in making. When yarn is twisted with a large number of turns per inch it loses a great deal of its strength and

this condition makes it impossible to handle in a bleached and dyed condition in most instances.

There are certain effects which cannot be produced in any other manner than through the use of bleached yarn, but manufacturers are not inclined to produce any quantity of such cloths, and when it is done it is rather hard to obtain the relative profits which are really necessary to make a satisfactory result. This fabric has been considered on a domestic basis of cost production and a mill should be able to accomplish the work at the figures given if they are in a position to manufacture wide cloth and produce yarn of the sizes and character used. Naturally there are but few mills in a position to do such work and the selling price for the cloth is probably high for such reasons. Because the cloth is made on a box loom which operates at a slower speed and because the cloth is rather wide the production in yards per week is comparatively small.

For this reason, it is necessary for the manufacturer to obtain a much larger amount of profit per yard than for most cloths. In this case he should obtain from 2½ to 3 cents per yard at least, to allow a reasonable profit on the cost of a plant. Inasmuch as a high-class novelty sells on style it is probable that a much larger amount per yard was obtained in profit. The retail selling price is $2 per yard and while this undoubtedly allows a very large rate of profit to the retailer, nevertheless the amount of duty necessary and the profits of the manufacturer and other sellers make the selling price of the cloth a comparatively reasonable advance on the cost of production. The rate of duty for this fabric is 10 cents per yard and not less than 40 per cent ad valorem. Probably the amount of duty was quite a little in excess of 10 cents per yard. The yards per pound in the grey state are 7.17, thus making the cloth sell at retail at approximately $15 per pound. The method of obtaining the weights of the yarn and the weight of the cloth is as follows:

2,954 ends ÷ (150/2 × 840) = .0469, weight of warp without take-up.
7% take-up in weaving.
.0469 ÷ .93 = .0504, total weight of warp per woven yard.

$$\frac{60 \text{ picks} \times 57\frac{1}{2}'' \text{ reed width} \times 36''}{36''} = 3{,}450$$

yards of filling (150/2) per yard.
3,450 ÷ (150/2 × 840) = .0548, total weight of 150/2 filling per yard.

$$\frac{30 \text{ picks} \times 57\frac{1}{2}'' \text{ reed width} \times 36''}{36''} = 1{,}725$$

yards of filling (60/1) per yard.
1,725 ÷ (60/1 × 840) = .0342, total weight of 60/1 filling per yard.
.0504 + .0548 + .0342 = .1394, total weight.
1.0000 ÷ .1394 = 7.17 yards per pound (grey).

PATTERN.

150/2 Sea Island combed $\frac{3}{20}$ 2,834 $\frac{3}{20}$ = 2,954, total ends.

150/2 Sea Island combed filling }
60/1 Am. combed hard twist filling } 90. total picks.

Filling averages in cloth 2 picks of 150/2 and 1 pick of 60/1.
50 reed, 57½" width in reed. 39½"-40" finished width.
74 × 92 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.		
150/2 Sea Island combed; 1¾" staple; 30 hank dou. rov.,	32c.	79¾c.	16c.	=	$1.27¾
60/1 Am. combed; 1¼" staple; 14 hank dou. rov.,	19c.	29¼c.		=	.48¼

COST.

2.954 ends 150/2 Sea Island combed + 7% take-up	= .0504	@	$1.27¾	=	$ .0644
60 picks 150/2 Sea Island combed	= .0548	@	1.27¾	=	.0700
30 picks 60/1 Am. combed hard twist	= .0342	@	.48¼	=	.0165
Weaving					.0603
Expenses					.0317
					$ .2429
Selling (grey)					.0065
Mill cost (grey)					$ .2494
Mill selling price (not less than)					.2800
Finishing, etc.					.0500

Rate of duty 40%.
Profits and expenses of various sellers not considered.
Retail selling price $2 per yard.
Yards per pound 7.17 (grey).

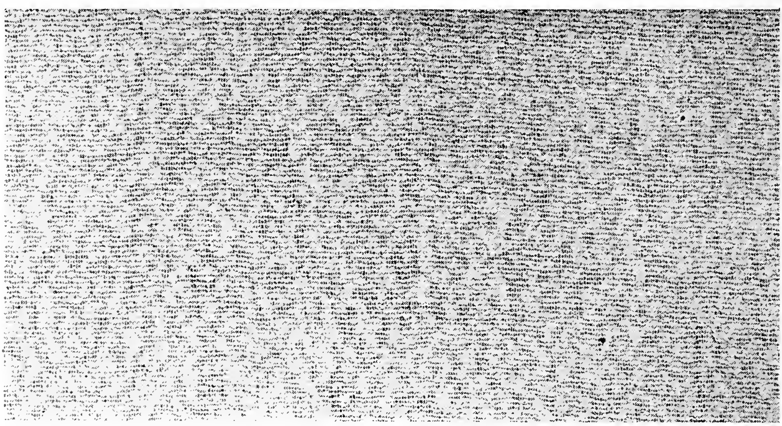
RICE CLOTH

(The Best Cotton Fabric for Spring.)

The question which has been uppermost in the minds of buyers of cotton goods during the past few weeks has been—What cloth can I purchase to take care of my distribution and be certain that a good profit will be secured and on which no slump is likely? Manufacturers have also been just as interested as buyers, for unless some kind of a novelty style is in good demand, it is very probable that none of the desirable profits which are often responsible for satisfactory mill operation are received. Possibly a short explanation of the conditions which exist may be desirable in view of the opinions of some sellers who are always trailers and who never achieve any remarkable success in cloth production and distribution.

Jacquard styles have been selling well and mills have quite a few orders for such goods, but in any case these styles do not have any great effect on the bulk of the distribution. Quite a portion of the jacquard styles being made to-day are considered as semi-staples and are not at all new. Good sellers state positively that the best of the demand for present styles in cotton jacquards is over, and that a declining demand, together with smaller profits, is certain for the immediate future. Then, there are the heavy novelty yarn fabrics which have sold well for a number of years.

In the East, where the greatest portion of distribution is noted, these cloths are dead or nearly so, and any one handling any sizable quantity is likely to sustain quite large losses. In the West such cloths are still in demand, but their production is not especially desirable to most manufacturers. Of course, certain of the newer colored yarn cloths have sold and probably will continue to sell well, but we are referring more particularly to grey woven materials. Another thing of interest, though known to comparatively few sellers, is that Southern mills have



Rice Cloth.

KILLED THE PRODUCTION

of heavy grey yarn ratinés for most Northern manufacturers.

When the demand for the heavy novelty yarn cloths first developed none of the Southern makers were acquainted with the yarn or cloth production, and so for a time prac-

tically no ratinés were made in this section. Gradually, however, a greater amount of knowledge was obtained and more manufacturers were able to produce them, so that to-day the quotation for a Northern fabric will be about 10¼ to 10½ cents per yard, while the same fabric will be sold by Southern makers at 9¼ to 9½ cents per yard.

This has forced quite a large share of the heavy grey yarn novelty cloth orders to be obtained by Southern manufacturers. There are facts of importance in the production of novelty materials which many Southern makers have not yet learned, but one of them which must be considered is that it is not a very good practice to make any quantities of novelty goods on a declining market. Another thing is that it is advisable not to sell up one's entire production when a fabric looks as though it might be a large profit maker. A waiting game with moderate sales to keep looms in operation will be responsible for much larger profits, for looms can then be sold when the rate of profit is at the highest point.

Another line of fabrics that has been desirable, and which will be in demand for spring, is that

ORDINARILY KNOWN AS CREPE.

There are certain objections to any big use of such cloths, although at present they appear as desirable as any other line, with the exception of rice cloth. For one thing they have never had a very long run, as consumers are apt to tire of them in a comparatively short time. For another thing the production of large quantities of crinkle effects, both woven and mercerized, has curtailed a great deal the possibilities of distribution for crepes.

The uncertainty regarding styles has made it possible for a comparatively new line called rice cloths to be developed. They are used for the same purpose as the other materials mentioned, but they contain ideas which are making a very large sale possible and are returning especially attractive dividends. It may not be generally known outside of circles where style tendencies are discussed, but nevertheless it is a fact that lighter fabrics are rapidly gaining strength and that another year will again see a large demand. This does not necessarily mean that there will be as large quantities of fine plain materials sold as formerly, because this will not occur until certain avenues of distribution which have been closed for some time are again available.

In addition to being of a light character, these rice cloths contain novelty yarn effects which are different from many of those sold in past years. The name probably developed from the fact that the small yarn bunches scattered over the fabric look something like grains of rice. The name itself is of value, for to most sellers ratiné is more or less stale and rice cloth at least sounds new. Large quantities have already been contracted for, and more will be purchased in the near future with very large mill profits. For grey cloths the prices run from somewhat less than 10 cents per yard to about 20 cents per yard, the latter price being the quotation for probably the most desirable cloth of this character offered.

THE CLOTH CONSTRUCTION.

There is nothing regarding rice cloths which present any great difficulties in manufacturing. As yet they are not being produced in Southern mills to any extent, partly because the yarns are somewhat finer than a good many Southern mills produce and partly because mills in this section have not been wide enough awake to realize the opportunity. In practically all cases, plain weave is used in the production of these cloths, and it is desirable to have them of a comparatively wide width, 40-inch grey being one of the big selling widths. The warp is an ordinary 50-1 warp, no different than would be noted for any medium weight plain cloth containing this size and count.

The threads per inch are comparatively few in number, thus creating no great difficulties so far as production is concerned. The filling yarn contains the features which produce the novelty effect in these rice cloths. The more bunches or extra yarn the

filling contains the more the cloth is likely to cost and to a certain extent the more desirable the material is likely to be. Because the filling is of a comparatively coarse character, due to the twisting process which has been used, the picks per inch are comparatively few in number. Naturally, the fewer bunches there are in the yarn the finer it will be when twisted, and when such is the case it is sometimes necessary to use a greater number of picks per inch. It is necessary to have a low warp count because should too many threads per inch be used they will cover up and largely spoil the effect desired. On most of the heavy ratinés the yarn sizes are relatively 4-1 or coarser, while in many of these rice cloths the relative yarn sizes are 7-1 or finer.

THE YARN MAKING.

Inasmuch as the warp is ordinary yarn, no description is needed for this portion of the fabric. The filling does, however, need quite a little attention not only because of the method of manufacture, but also because of other features. In the first place, the filling used in these rice cloths is not composed of as large a number of ends as have been used in many of the ratiné cloths which have been selling. Filling for rice cloth, in most instances, is a twisted yarn composed of only two threads and in which but a single twisting operation has been used, while in many of the ratinés four threads were used and two twisting operations were necessary to obtain the result.

There is a great deal of advantage in making a two-ply twisted novelty, because much less handling is necessary resulting in a lower cost of production. Often yarn of this character is produced on an ordinary spinning frame, the yarn, when completed, being ready for the loom, with no succeeding processes. All that is necessary for satisfactorily producing such yarn is a frame which contains two separate sets of rolls and on which one set of rolls can be stopped at various intervals. This question of stopping the operation of the rolls is an important one in obtaining satisfactory results. If possible, they should be stopped irregularly, so that the yarn bunches in the finished result will appear irregularly in the cloth and not be likely to form what are called patterns.

It is sometimes a good policy to use a box loom when weaving cloth of this character, as it tends to eliminate some of the foregoing difficulties. There is one thing, however, regarding the

PRODUCTION OF NOVELTY YARN

with only two threads, and this is that the result is not bound closely enough to make it suitable for use as warp. The loose yarn will slip to a greater or less extent on the ground yarn, but not to a great enough extent to make the use impractical, that is, if enough twist has been inserted. When the correct amount of twist is used, the ground yarn will contract somewhat in twisting, and in doing this when the bunch is being formed will run the extra thread down on the ground yarn, thus binding the bunch much more firmly than would otherwise be possible.

Special twisters have been made to perform this operation regularly, but with the correct yarn sizes and the right amount of twist it is hardly necessary for a fabric such as that described. The yarn which forms the nub or bunch, namely 36.5-1, is delivered approximately two and one-half times as fast as the ground yarn which is 50-1. There is, however, quite a large take-up in the twisting operation even upon the ground yarn, making the resulting yarn size much coarser than would be expected. With the take-ups which are noted, namely 27 per cent upon the 50-1 ground and 71 per cent upon the 36.5-1 loose yarn, the relative yarn sizes will be 36.5-1 for the 50-1 ground yarn and 10.585-1 for the 36.5-1 loose yarn.

Through the use of the method for obtaining a two-ply yarn size when yarns of different sizes are twisted together, namely, dividing their product by their sum, we obtain a resulting novelty yarn size of 8.20-1, or a yarn containing 6,888 yards per pound. With this as a basis, it is a comparatively easy matter to obtain the cost

per pound of the novelty yarn, but it is absolutely certain that the majority of manufacturers do not adopt any accurate method for obtaining their novelty yarn costs, and for this reason they do not know the profits they are obtaining nor anything like an accurate cost for their goods, although it might be said that when such fabrics are in demand the profit is usually high enough to place them on the right side of the transaction.

THE YARN COST.

It will be noted that we have obtained the cost of the yarns used in making this novelty result, using regular 50-1 warp, a method which probably the majority of mills would be forced to adopt. Under this condition the cost to the mill when economy is practiced is 37½ cents per pound for 50-1 and 23½ cents per pound for 36.5-1. Inasmuch as the novelty yarn contains 6,888 yards per pound, the use of the yarn costs, together with the relative sizes which they are when the take-up in twisting is considered, will give the cost of the various yarns used in making a pound of novelty filling. This gives 8.43 cents as the cost of the 50-1 and 18.21 cents as the cost of 36.5-1 in a pound of novelty yarn. The total cost of material per pound for the novelty yarn is therefore 26.64 cents, the result being much nearer the price of 36.5-1 than for 50-1, because a much larger portion of the weight is of the heavier yarn.

This cost of material is not the cost of the finished yarn, because there is the labor and expenses which are noted in the twisting process, and in addition there is a certain amount of expense noted for experimentation when certain of these novelty yarns are produced. In a yarn like that used in the sample this experimentation charge should not be very large because the quantities of the material needed for any moderate size of order is quite large, and besides there is no great difficulty, if a manufacturer knows his business, in being able to duplicate yarn such as is used, at least so far as practical purposes are concerned. The yarn production in pounds per week will not be nearly as large as the actual size when twisted would indicate, because the turns per inch are very much greater than in a normal yarn of the size noted.

THE POSSIBLE PROFITS.

Due to unfamiliarity with all kinds of novelty yarn fabrics, buyers have often been willing to pay prices for such cloths as to return some extraordinary profits. We are absolutely certain that in a good many cases manufacturers have not realized the rate of profit which they were obtaining, but this fabric shows a condition which exists to-day generally upon rice cloths. The reason why they do not know the rate of profit secured is because they do not investigate the cost of production in an accurate enough manner, the trouble being mainly because of the shrinkages and various other details which affect the cost on the novelty filling. This cloth could be produced by an economical mill for the price which we have figured, namely 12.36 cents per yard, but in the estimates which we have given regarding profits we have allowed a somewhat higher cost than this, so that there could be no question regarding results.

The selling price to-day for the fabric which we have analyzed is 20 cents per yard. This allows a net profit to the mill of over 7 cents per yard. for a fabric which contains only 34 picks per inch. This, it will be recognized, is a condition which seldom exists for manufacturers who can produce a high-class fabric in quantities. The small number of picks per inch makes it possible for quite a large number of yards of cloth to be produced per loom per week. Ordinarily fancy mills attempt to obtain a net profit of about $2 per loom per week, or, in other words, $100 per loom per year, which will return a net profit of in the vicinity of 10 per cent for fancy goods. This cloth, instead of showing the ordinary $2 per loom per week, shows at least $18.75 per loom per week, or about $937.50 per loom per year.

It must be remembered that this cloth is not produced upon a fancy loom, but rather upon a plain loom

which can make grey cloth 40 inches wide. Under these conditions the capitalization per loom will not be as high as for many mills containing fancy looms. The obtaining of a profit of over $900 per year per loom makes it possible for a rate of profit to be secured of approximately 117 per cent. If this result was being secured on very small quantities of cloth and by only one or two sellers no attention would be given to the matter, but it is being secured on large quantities of cloth and by quite a number of sellers. Not only is this profit being secured on this fabric which is selling for 20 cents per yard, but a similar, or approximately similar rate of profit is being secured on the various qualities of rice cloths which are selling down to the price of 10 cents per yard.

We do not claim that this high profit is a usual one, because it is not, but the situation is worth discussing from a mill standpoint, and because a large sale is going to take place it is desirable from a buyer's standpoint. It will be noted that we have given approximate selling prices for the converter and retailer when sold direct. Much of this cloth will not be sold in this matter and undoubtedly some of the best grades will command a price of at least $1 per yard at retail. Just how long conditions will remain as they are and these high profits be secured is questionable, but most mills can produce such fabrics and will not long remain passive when they have looms idle for the want of orders.

FINISHED RESULTS.

These fabrics are practically all made from grey yarns and are therefore treated to the processes which are customary for grey cloths, that is, they are bleached and sold in the white state, and in other instances are dyed any solid color which happens to be desirable from a buyer's viewpoint. At present converters are getting out lines of rice cloths which contain small printed figures or in which quite a large portion of the ground is evident, and these are expected to have a very large distribution. Due to the fabric construction and method of making they are never mercerized. There has been no great attempt as yet to get fabrics out to sell at a price because there has been such a demand that mills could often obtain more than their asking prices, in certain cases receiving 2 cents at least more than their asking price, which naturally would contain a rather high

RATE OF PROFIT.

The yarns composing these fabrics have not been manipulated to any great extent up to the present, but there is a certain amount of opportunity for producing effects which have not been developed as yet. There are certain effects which cannot be produced when cloths are made from yarns such as are used in the fabric described. The fact that the material is different from what has formerly been sold, and the fact that large quantities are being made is sufficient to show buyers who have not purchased any that they are losing the chance of making large profits when they are available.

Any cloth which shows a very high rate of profit to a manufacturer is likely to show as large, or a larger, rate of profit to a succeeding seller, and until competition develops more than is noted at present the profits will be very satisfactory. After the novelty yarn size has been correctly obtained there is no great difficulty in obtaining the weights of the yarns and the cost of the cloth.

It is always a good policy to obtain the actual novelty yarn size through weighing and then to obtain the figured yarn size through the use of take-ups and the yarns used in its production. Of course, it is necessary to obtain the details regarding the novelty yarn size in order to obtain a correct cost, but the knowing of cloth details is not only of interest to manufacturers and buyers, but oftentimes is of great value in obtaining desirable results. The various weights are obtained as follows:

2,380 ends ÷ (50/1 × 840) = .0567, weight of 50/1 warp without take-up.

9% take-up in weaving.

.0567 ÷ .91 = .0623, total weight of 50/1 warp per yard of woven cloth.

$$\frac{45'' \text{ reed width} \times 34 \text{ picks} \times 36''}{36''} = 1{,}530 \text{ yds.}$$

of filling per yard of cloth.

1,530 ÷ 6,888 or (8.20/1 × 840) = .2221. total weight of novelty filling per yard of cloth.
.0623 + .2221 = .2844, total weight per yard.
1.0000 ÷ .2844 = 3.52 yards per lb. (grey).

during recent years, and that the reduced prices would make a large sale possible, making such materials comparatively staple in fancy goods.

PATTERN.

50/1 Am. combed warp 40 2.300 40 = 2.380 total ends.
8.2 novelty filling, composed of 50/1 Am. combed and 36.5/1 Am. carded; 34 picks per inch.
26 reed, 45" width in reed, 40" grey width, 38" finished width.
59 × 34 grey count; 62 × 34 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
50/1 Am. combed warp; 1 5-16" staple; 10 hank dou. rov.,	21c.	16½c.	=	37½c.
36.5/1 Am. carded warp; 1⅛" staple; 7¼ hank dou. rov.,	15½c.	8c.	=	23½c.

NOVELTY FILLING.

1 end 50/1 ground yarn, take-up in twisting 27%.
1 end 36.5/1 nub or loose yarn, take-up in twisting 71%.
Relative yarn sizes in novelty (50/1 = 36.5/1) (36.5/1 = 10.585/1).

$$\frac{36.5 \times 10.585}{36.5 + 10.585} = 8.20, \text{ novelty size when twisted (or 6,888 yards per lb.)}$$

$$\frac{6{,}888 \times 37\tfrac{1}{2}\text{c.}}{36\tfrac{1}{2} \times 840} = 8.43\text{c. cost of 50/1 in lb. of novelty yarn.}$$

$$\frac{6{,}888 \times 23\tfrac{1}{2}\text{c.}}{10.585 \times 840} = 18.21\text{c. cost of 36.5/1 in lb. of novelty yarn.}$$

26.64c. total cost of material per lb. of novelty yarn.
3.50c. cost of twisting, experimentation, etc.

30.14c. total cost of novelty yarn per lb.

CLOTH COST.

2,380 ends 50/1 Am. combed warp + 9% take-up = .0623 @ 37½c.	=	$ .0234
34 picks 8.20 novelty filling = .2221 @ 30⅛c.	=	.0669
Weaving		.0215
Expenses		.0093
		$ .1211
Selling (grey)		.0025
Mill cost		$ .1236
Mill selling price to-day (grey)		.2000
Cost of bleaching and finishing		.0200
Converter's expenses		.0260
Cost to converter (total per yard)		$ .2460
Converter's selling price to retailer (when handled direct) about		.3000
Retail price (when handled direct) up from		.4600

Plain weave
Yards per pound 3.52 (grey).
Mill profit at least $18.75 per loom per week, or about $937.50 per loom per year.
This gives a rate of profit of approximately 117%.

TUSSAH BROCHÉ

The line of fabrics which are probably of as great interest to buyers of novelty goods as any others, and on which quite a little anxiety has been created because of the raw silk market is that line of cloths which contain silk of various kinds. Some time ago we gave a description of a silk and cotton mixture material stating that the prices had declined greatly

Various conditions have been responsible for the large use of silk and cotton cloths, but it is only recently that the style and the finish has developed to its present state. Jacquard patterns have been very desirable in all kinds of silk and also woolen materials and the same condition has been more or less true in cotton goods.

Inasmuch as the combination of cotton and silk results in effects not possible in all cotton fabrics there is a very good reason why such combinations should be made at present

even if they are not so desirable at other times. Dress materials have been produced with very large patterns, and with figures not ordinarily seen the present season, and the fabric we are illustrating shows one of the radical combination materials which are being used quite extensively for dresses. In ordinary seasons this pattern would be much more desirable for other purposes than for dresses, but nevertheless style is becoming of such great importance to consumers that the cloth construction and prices even are of less importance than formerly.

It was believed some time ago that the making of silk and cotton fabrics by cotton mills would not affect greatly the production of

COMBINATION MATERIALS

in silk mills, but there has been more or less trouble because of this production and many styles which were formerly made in silk mills cannot longer be produced by such manufacturers because the prices are quite a little less, partly through the larger quantities made, the great economy practiced and the lower finishing costs.

These mixture materials have built up a field of their own to a large extent, which is separate from the silk and also from the cotton goods trade, but the large number of purchases of such goods has eliminated a portion of the silk sales. At present the demand for all silk fabrics is better than it ever has been in the past, but were it not for the silk mixture materials, it is entirely probable that the demand for all silk goods could not be supplied. Consumers' tastes have improved so fast that the making of these goods cannot be considered anything but a great advance in manufacture and distribution.

There are various items of interest in regard to silk and cotton fabrics, probably the item of greatest interest being noted in the method of producing. When cotton mills go into the making of silk fabrics extensively they have to consider various production features or else results are not as satisfactory as they may be. Cotton mills have been planned to produce cotton fabrics and the number of spindles installed for the making of warp and filling has been such that they can take care of the loom production in a satisfactory manner. Cotton mills have practically no facilities for

HANDLING RAW SILK,

and if they were to install such facilities it would be quite difficult to train the operatives when they are not used to such materials. For this reason much of the silk which is used in cotton mills has to be purchased in a form ready for use. This means that the filling is purchased on quills to use in the weave room shuttles, and that warps when stripes or silk warps are to be used are purchased on beams ready to be drawn into the harness.

Through the purchase of silk there are a certain number of spindles which have been operated on cotton eliminated, together with the machinery which is necessary for previously handling the cotton stock. Unless great care is used much of this machinery which formerly operated on cotton yarn will be idle, and if costs are not considered accurately the results obtained from mixture goods will not be as satisfactory as estimates would indicate. Under these conditions it is a good plan to take orders for cotton yarn at cost, or at a small profit rather than to allow the machinery to remain idle, or else it is a good plan to organize a new company and have nothing only weaving machinery or machinery for preparing yarn for weaving machinery in the mill.

Few domestic manufacturers have adopted this latter policy, and naturally, have been compelled to sell yarns or let their machinery stand idle. Keeping all the machinery in operation or making the organization balance is one of the most important features in fancy cloth making and is one of the fundamentals which is responsible for success or failure. Certain mills which have sold a good many silk and cotton fabrics have taken orders for these cloths at a good profit and sold up all their spin-

ning machinery available at cost. In some cases mills handling silk filling have installed

SILK QUILLING FRAMES,

and have purchased their silk on spools, and a very few purchase silk skeins. There is no great advantage in cost in purchasing silk on spools rather than on quills, because silk throwing mills are not anxious to sell silk in this manner, inasmuch as they have spooling machinery and are just as anxious to keep their machinery balanced as cotton mills are.

The advantage of having silk quilling machinery is, however, in the smaller percentage of loss from bad quills, and in being able to handle the silk as desired, often on somewhat larger quills than silk mills are used to selling it on. This is especially true on the heavier sizes of silk such as Tussah and similar grades rather than on the finer sizes such as are used in the lighter silk mixed cloths.

Many manufacturers who have never had any experience with silk cloths have been prejudiced against attempting their manufacture, believing that a great deal of trouble will arise, and that the costs of production will not be as low as are indicated from selling prices. For various reasons their ideas are mistaken ones. In the first place when all silk warps are used and the operatives become familiar with silk yarn it is possible to start up warps much quicker and have much less loss than when all cotton is used. Another thing is that the percentage of production is in a large majority of instances quite a little higher than when all cotton goods are being made.

This is partly because the silk is

MORE REGULAR THAN COTTON,

and also stronger and fewer breakages occur to stop the looms. For similar styles of goods it is practically always possible to operate as many looms when silk is used as when cotton is used, and this makes the cost of weaving, together with expenses, at least no more than when the same number of pick cloths of cotton are being produced. There are certain features regarding the purchasing of silk which have to be considered very carefully. Cotton mill managers are familiar with cotton, but they are not so familiar with the technical features of cotton, and are many of them almost ignorant regarding silk.

Due to the affinity of silk for water it used to be a custom with some silk sellers to weight up the silk with this material before it was sold for cotton mill use. In this manner, many manufacturers were forced to pay a large amount per pound and receive a much larger percentage of water than they naturally should. There are some sellers who never adopted this policy, but when low quotations were formerly named, it was very likely that such methods had been adopted. This is one reason why manufacturers should do business with silk houses who have reputations of the highest class.

It is also true that there is a great variation in the yardage received in various sizes of silk. Silk manufacturers are many of them accustomed to making tests, or having them made at a conditioning house, which will determine accurately the number of yards which their silk purchases will average, but this is not noted in cotton establishments, partly because they have no facilities, and partly because their purchases of silk are often likely to be in small quantities when compared with the purchases of silk mills. For the above reason it is always a good plan for a cotton cloth maker to size his silk as accurately as possible with an ordinary yarn reel, and then when estimating his cloth weight to allow a lower yardage for the silk than it actually contains as a protection against silk variation.

This has been done in the fabric which has been analyzed, a lower yardage being given than the silk actually sizes. This yardage has been used in the cloth estimates as 55,000 per pound. It is also possible to quill silk of as heavy size as that mentioned on ordinary cotton quills, and in this manner a much larger percent-

age of production is obtained than when small silk quills are used. It often makes it possible for more looms per weaver to be operated, and it is claimed that in some mills more looms are operated than on the same kind of all cotton goods.

An interesting feature in this connection is noted from the development during recent years in the making of these cloths. Possibly about ten years ago the greatest number of looms per weaver on silk filling cloths such as that analyzed, was four. Gradually this number was increased to five, and soon afterward weavers were given six looms with very little loss in production. Without doubt, six looms could have been operated much earlier than they were, but it was not attempted because of unfamiliarity with silk.

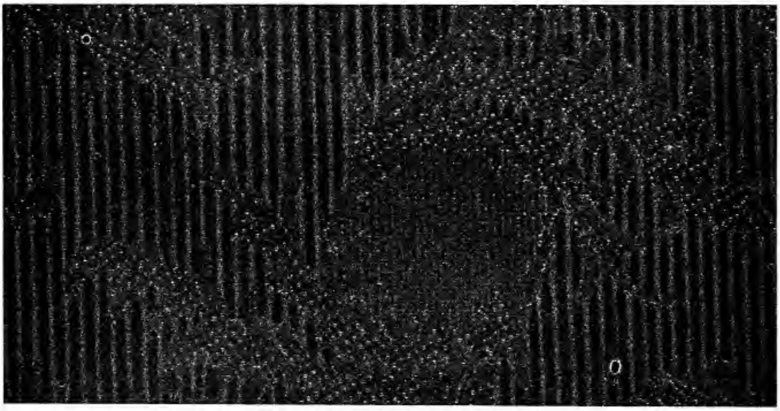
To anyone not familiar with manufacturing the most

INTERESTING FEATURE

of a fancy cloth, such as that considered is the weave, and for this reason it may be well to give a short description regarding this item. In the first place it may be well to state that the actual making of many of these so-called fancy jacquard weaves, in which silk filling is used, is a much more simple process than the making of many fancy dobby patterns. In a single cloth such as that considered, there are only two positions which the warp or filling can have, that is, it can be either on the face or back, but it must be either one or the other, and not both. This fabric is of interest because it is necessary to have two warps made up of identical yarn.

This is because of the weave used, for of the three threads which form the ground weave of the fabric, one of them has a much greater take-up than the other two, which are drawn in together and operate as one. This will be noted from the analysis which we have given. Due to the weave there will be three threads drawn in each dent of the reed throughout the entire cloth, instead of the two threads so often noted. The first process in making a pattern, such as that illustrated, is to make a cloth sketch exactly as it will appear when the fabric is woven.

Often this cloth sketch is made by the styler in the employ of the buyer, while at other times the sketches are produced by parties who do nothing else, and sometimes the sketches are produced at the mill from ideas given by buyers or obtained from other materials. It is not always possible in a



Tussah Broché

cloth sketch, which has been painted, to introduce some of the features which may be desirable in the cloth pattern, but usually the idea can be worked out so as to be satisfactory. When this cloth sketch has been completed, it is ruled up into divisions to correspond with the fabric construction. This is explained as follows: A 400-jacquard head contains 50 rows of hooks, with eight hooks in a row, making a total of 400 hooks. These hooks are connected to harness cords and are placed in a board on the loom which contains small holes in regular order in the number decided when the loom is installed.

If a cloth is desired in which only 360 hooks of the 400 are to be used, then there will be of the 50 rows of hooks in the total machine, only 45 in use. The five remaining rows of hooks, which are not in use, will not have any threads drawn in them and will remain idle. In this case given above the design or cloth sketch will be ruled up into 45 equal parts. When this has been done the correct design paper to use will be ascertained. For a 400-machine with eight hooks in a row there must be a design or point paper with eight squares in it in one direction used. The squares in the other direction, or filling, will correspond to the cloth count when finished, and for the cloth in question the paper would be 8 by 5, which is the nearest size.

When the size of the design paper or point paper, as it is often called, is ascertained the cloth sketch is transferred to the larger paper, placing upon this paper only the outlines of the various figures so as to appear in the best manner possible. When the outlines have been drawn the weave is painted in. This is a

TEDIOUS PROCEEDING

in a good many cases, but it is not especially difficult for many styles of fabrics. It may be well to mention, however, that it is the small details which are carefully worked out in the making of designs which produce desirable results. We have often seen designs, which would have otherwise been attractive, entirely spoiled because enough care had not been used in transferring the patterns or in painting the weave.

When the weave has been entirely painted in, the design is given to the card cutter, who cuts the weave on the cards as indicated, a single pick across the design being represented by a single card. When a hole is punched in the card it allows the needle at the top of the jacquard frame to remain in place, and will cause the thread in such hook to be lifted, whereas if no hole is cut the needle will be pushed back, and the hook will remain down with the filling or shuttle passing above the warp thread. When the cards are all cut, one for each pick in the design, they are taken and laced together, sometimes by hand, but more often by machine, a machine which acts in a similar manner to an ordinary sewing machine. When this process has been completed the cards are placed on the loom and are in a condition to weave the cloth. The entire process is very simple, but the multiplicity of details often confuses those who are not familiar with manufacturing processes.

Most of the patterns in silk and cotton goods are made with the silk figure on the

FACE OF THE CLOTH.

When silk filling is used this means that filling float patterns are employed extensively, and when silk warp is used that warp effects predominate. Of course in certain instances, both warp and filling combinations are used in order to produce certain effects, but the above statement refers to the majority of styles. One of the conditions which is causing a great deal of difficulty in the making of silk and cotton fabrics is that the price of silk has advanced radically during recent months. When cotton manufacturers developed styles for next spring's use they were able to obtain silk at much lower quotations than they are at present, and buyers expected to obtain cloth at the quotations which were made on the orig-

inal orders, but this has not been possible, and advances have been necessary, so much so that many lines have been eliminated or made much less desirable from a buyer's standpoint.

The finishing of silk and cotton goods is one of the items which has been responsible for the enormously increased sale. The styles which were produced a few years ago would hardly be taken as the same construction with the finish which is applied today. When combination materials are bleached it must be done by a process which will not harm either fibre, and it is impossible to use the ordinary lime bleach which is generally used in all cotton establishments. Another item of interest is in regard to the silk yarn which has been used. All kinds of silk contain a greater or less proportion of gum when in their raw state, and the boiling and bleaching processes used in finishing eliminate quite a large portion of this gum.

SILK FINISHERS

are likely to replace a portion of this gum when they finish silk cloths, but on most of the combination materials this is not done, and is responsible for the greater yardage of silk per pound when the cloth is sold than when the cloth is woven; in other words, finishers of cotton goods are not accustomed to add weighting in a similar manner to that employed by silk finishers or dyers. Possibly one of the reasons why the silk and cotton fabrics have been desirable to buyers has been because of the variety which could be obtained in the finishing of the cloth. Due to the character of the material used, namely, cotton and silk, it is possible to dye the cloth any solid color and in addition it is possible to dye the cotton a certain color and allow the silk yarn in the material to remain white.

Some finishers are more successful in obtaining clear whites than others, but nevertheless results can be obtained which are commercially satisfactory. In addition to the above, it is possible to dye the cotton yarn in the fabric one color and to dye the silk yarn in the fabric another distinctly different color. This has been done in the fabric which has been analyzed, and makes it possible to show up the figure much more effectively. The various finishing methods make it possible for a converter or buyer to offer a greater variety of results even though the grey cloths were all identical. Consumers demand more variety than ever before and combination materials have been partly responsible for supplying this

GREATER VARIETY.

In obtaining the correct weights in a fabric of this character, it is necessary to obtain accurately the take-ups on the various warps. Only experience can determine what size of silk is correct to use for any silk yarn, although the use of a somewhat coarser size than the yarn actually is will give a certain amount of protection. When the finished yarn sizes are obtained accurately, and their probable grey sizes estimated, it is easy enough to obtain the weights of the yarns used and the weight of the woven fabric. The process is as follows:

2,152 ends ÷ (30/1 × 840) = .0854, weight of 30/1 ground warp without take-up.
3% take-up in weaving.
.0854 ÷ .97 = .0881, total weight per woven yard of 30/1 ground warp.
1,116 ends ÷ (30/1 × 840) = .0443, weight of 30/1 top warp without take-up.
8% take-up in weaving.
.0443 ÷ .92 = .0482, total weight per woven yard of 30/1 top warp.

$$\frac{74 \text{ picks} \times 26\tfrac{1}{2}'' \text{ reed width} \times 36''}{36''} = 1{,}961$$

yards of filling per woven yard.
1.961 ÷ 55,000 yards per lb. (silk) = .0357, total weight of silk per woven yard.
.0881 + .0482 + .0357 = .1720, total weight per woven yard.
1.0000 ÷ .1720 = 5.82 yds. per lb. (grey).

PATTERN.

30/1 Am. carded warp		2			2,152 Beam 1.
30/1 Am. carded warp	$\frac{2}{10}$	1	$\frac{2}{10}$	=	1,116 Beam 2.
		$\underbrace{\quad}$ 1,076 ×			3,268 total ends.

32/38 2-thread Tussah silk. 74 picks.
41 reed, 26½" width in reed, 25½-26" grey width, 25½" finished width.
123 × 73 finished count.

YARN.

	Cotton.	Labor, waste, etc.		
30/1 Am carded warp; $1\frac{1}{16}$" staple; 6 hank dou. rov.,	14c.	6½c.	=	$ .20½
32/38 2-thread Tussah silk, on quills ready for loom..........			=	2.35

COST.

2,152 ends 30/1 Am. carded warp + 3% take-up..........	= .0881	@ $ .30½	=	$ .0269
1,116 ends 30/1 Am. carded warp + 8% take-up..........	= .0482	@ .30½	=	.0147
74 picks 32/38 2-thread Tussah silk..........	= .0357	@ 2.35	=	.0839
Weaving				.0134
Expenses				.0182
				$ .1571
Selling (grey)..........				.0032
				$ .1603
Mill selling price to-day (about)..........				.1775
Cost of dyeing, finishing, etc..........				.0300
Converter's expenses				.0225
Price to jobber				.2750
Price to retailer				.3250
Price to consumer				.4600

Yards per pound 5.82 (grey).

WOVEN SEERSUCKER STRIPE

One line of fabrics which has not been in very large demand for a number of years past, but which recently has been selling in large quantities, is that line ordinarily known as seersuckers. It must not be supposed that these cloths do not have a more or less regular distribution, but as is the case with other materials, there are certain times when the demand is much larger than usual. Most of such fabrics are desirable for many uses such as dresses, waists, rompers, children's garments and various other purposes. Generally they are firm fabrics and will return quite a large amount of value, inasmuch as they are woven with comparatively coarse yarns and are of heavy weight.

ONE OF THE GREAT ADVANTAGES

of these fabrics is that they do not have to be ironed similar to most other materials after they have been washed. The nature of the cloth permits this process to be dispensed with, and therefore makes the material suitable for many uses where washing can be accomplished but where there is little opportunity for any ironing process. There are two distinct classes of woven seersucker materials. First, that class which is made from carded yarns, and, in the majority of instances, contains more or less colored yarn, and second, that class of fabrics which is woven from grey yarns and may be produced from either carded or combed stock and sold in the white state or may be piece dyed.

Of course, it is possible to produce the first class of fabrics mentioned from combed stock, but, due to competition in price and various other features, it is seldom done. Without question, the second class of fabrics returns much more value than the first class, but it has often happened that the style of this class of materials has been somewhat lacking, due to the absence of color. To-day this is not so necessary, inasmuch as colors fast to bleaching can be used, although up to the present few of such fabrics have been made. The

NOTICEABLE FEATURE

of these seersucker fabrics is the crinkled appearance of a portion of the cloth. This crinkled portion is, in all the fabrics we have mentioned, a woven one, will not pull out and

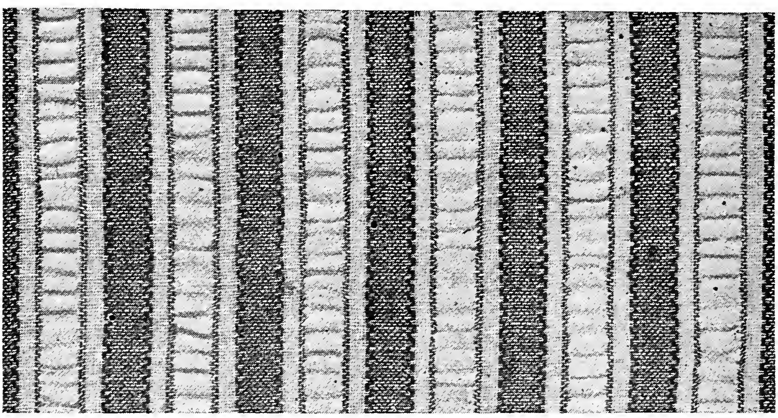
might be said to be permanent. The degree of crinkle will vary in different fabrics, depending upon the cloth construction and certain features in making. The effect is produced in the following manner: In ordinary fabric weaving the beam upon which the warp yarn is placed is held quite tightly, either through weights or in some other manner. This beam is let off either mechanically or through friction, so that as the reed forces the picks into the cloth, enough yarn is pulled off to allow for the weaving of the fabric.

This above condition is noted upon one of the beams used in making a seersucker fabric, and is the portion of the warp in which there is no crinkle. For the crinkle portion, an extra beam is necessary, and there is very little weight used upon such beam, so that as the reed forces the picks into the cloth it also pulls down a certain amount of yarn, which extra yarn creates the crinkle in the fabric. There are other reasons why the crinkle is formed, one of them being the fact that extra yarn is used in the stripe where the crinkle is made. This extra yarn causes greater friction and makes the effect more prominent.

Crinkle effects can be produced without the use of extra yarn. but they are not likely to be so satisfactory as where extra yarn is used. Not only does the extra yarn cause more friction with a greater yarn let-off, but it also makes that portion of the fabric where the crinkle is produced more prominent, due to

ITS HEAVIER CHARACTER.

In our analysis we have given two different layouts for the warp patterns, the first one being that which relates to the different colors and their arrangement in the cloth. The second is the method of placing the yarn on the beam. The ground beam contains both white and colored yarn, for the take-ups on these ground yarns are identical. The second beam contains the crinkle yarn, upon which there is a much greater take-up. With these two layouts there should be no great difficulty in determining just the method which is used in making the cloth pattern.



Woven Seersucker Stripe.

In addition to the layouts as given, we are presenting the fabric weave as it appears in the cloth. It will be noted that certain threads weave differently than others. In some instances a basket weave is used, in others a plain weave, while in still other instances the threads weave as

plain, with the exception that instead of a single thread there are two alongside which work identical. Underneath the design we have given the reeding plan, which indicates the number of threads to be drawn in each dent in the reed. It will be noted that where the threads weave otherwise than the ordinary plain weave they are drawn four threads in a dent. The obtaining of desirable results in many varieties of cloth is partly due to the correct placing of the threads in the reed. It often happens that through

A CORRECT METHOD

satin stripes can be woven from the same beam as ground threads of a plain character and at other times incorrect reeding will cause a great deal of trouble in cloth making.

Sometimes, the percentage of production will be unreasonably low, just because enough attention has not been given to this feature of cloth planning. In drawing in a fabric of the character analyzed, it is possible to use two methods, the first where a single thread is drawn in every heddle, even though some of them work the same as those alongside. The second method is where two threads are drawn in the same heddle whenever they operate in the same manner. This latter method is the one generally employed, although in a certain few instances it has been found more desirable to use the first method. One reason why the second method is better is because it decreases the number of heddles necessary and allows more space for the threads or harnesses to operate as the cloth is being woven. When this method is taken it is, however, possible for single threads to weave in the heddles where there should be two threads being used.

Without doubt the sale of woven crinkle effects would have been much larger than it has been; in fact, it is believed that the sale would have been very much larger than it ever has in the past, were it not for the fact that many somewhat similar effects have been produced during the last two years by other methods than weaving. Inasmuch as many consider this second class of fabrics on the same basis as the ones previously mentioned, it may be well to give a short description regarding them and their methods of making. These latter materials are not produced by the weaving process, that is,

THE CRINKLE EFFECT

is not produced in such manner. Most manufacturers and practically all converters and finishers are familiar with the fact that the mercerization process will cause quite a large cloth shrinkage if it is used and the fabric not held out tightly.

It is upon this contraction that the printed crinkle effects are obtained. Upon certain portions of the fabric, by methods somewhat similar to the ordinary ones used in making printed patterns, is placed a solution of caustic soda. This solution causes the fabric to shrink radically where it is applied, and when this shrinkage occurs it causes the remainder of the fabric to crinkle up and makes the effects which are not used so extensively. On this style of fabric various printed patterns can be placed in different colors, and the large sale has been possible because the fabrics are desirable, not only because of style but also because of a comparatively low price.

Finishers who handle fabrics of this character demand a 25 per cent working loss, which is about the extreme amount of shrinkage that mercerization is likely to cause, but it has been found that on most lines of these cloths the loss to a converter because of shrinkage will be about 18 per cent, though in some few instances it has run as high as 20 per cent. This loss in shrinkage is a serious matter to the converter and must be accurately known if a correct cloth price be obtained. When a fabric loses in length anywhere from a fifth to a sixth it naturally makes the value of the material just that amount greater than it previously was, for it increases the number of picks per inch the relative amount named.

The fabric analyzed, and which, as stated previously, is a woven effect is produced in large quantities regularly.

The retail price is 15 cents per yard, thus allowing the regular distribution prices to be noted. It is seldom that retailers can purchase such a fabric at less than 10½ cents per yard, and it is almost impossible for jobbers to force retailers to pay over 11 cents per yard for this sort of fabric. The commission house price on the cloth is about 9¼ cents per yard. Retail prices show a much smaller advance over the cost of production on fabrics of this character than they do on most other lines of fancy fabrics. This is because the materials are produced in large quantities, making it possible for satisfactory returns to be obtained because of large quantities sold rather than high profit through the sale of small amounts.

One of the great advantages in a mill producing a fabric of the character described is that a great variety of results can be obtained, even though the cloth construction does not vary widely. In all these cloths the construction is identical, so far as the count in the ground cloth is concerned, although there is a small variation in warp count, due to the different arrangement of crinkle stripes. The effects are obtained through the color arrangements and the different spacings and arrangements of crinkle stripes and not through the variation in yarn size which is necessary in other styles of fancy fabrics made from grey yarns.

One of the features which has been of decided advantage in the production of printed crinkle effects is that there has been a great variety of results possible, due to printed patterns and different arrangements of stripes. While different effects are possible in greater or less amount on many styles of plain fabrics it is not often that the variety possible is as great as is noted on the printed crinkle materials. Sellers all desire to

PURCHASE LARGE AMOUNTS

of a ground fabric, for in this manner they can obtain very low prices, but unless the ground cloth can be finished in many attractive ways which are in demand at the time, it is not always a good policy to make large purchases.

In the majority of instances the yarns used in the making of woven crinkle effects, where colors are used, are in the vicinity of 30-1 warp and 40-1 to 45-1 filling. Of course, there are some finer lines than that mentioned produced, but their sale is comparatively small when the total distribution is considered. One of the great objections to all fabrics which are made from bleached and dyed yarns is that their appearance is not so regular as cloths which have been produced from grey yarns and then are afterward finished or dyed. The picks in fabrics woven from bleached and dyed yarns are not worked into their positions so smoothly as those which are finished after being woven, and often the reed marks show in such a prominent way that much of the desirable fabric effect is lost.

It is true that some styles of grey yarn fabrics show reed marks after they have been finished, but the number is so small in comparison to fabrics made of bleached yarn, that it is not worth while considering them. It is believed that manufacturers could have done much more with crinkle effects produced from grey yarns and with a certain amount of fast color used in their construction than they have done. Profits are often quite large through the adoption of methods not in general use and makers should allow no opportunities to slip past without making the most of them. Possibly one of the greatest advantages in making these

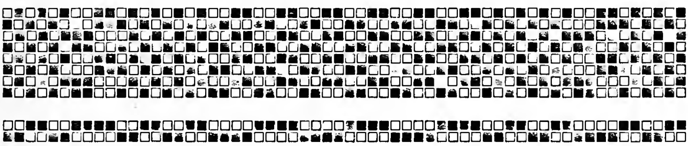
CLOTHS FROM GREY YARNS

is that which is noted in most other styles of fabrics, and is that fine grey yarns can be handled much more satisfactorily and at a much smaller relative cost than bleached yarns of the same character. In the majority of instances it is not possible for colored yarn mills to handle yarns much finer than 50-1, while this is a comparatively low count for many grey cloth makers.

The difficulties in weaving are not especially prominent, but it is not possible for a weaver to operate as many looms on constructions such as that analyzed, as it is on similar

classes of ginghams, or shirting stripes. The uneven tension on the top beam, and the fact that the threads are reeded quite closely in the dent where the crinkle is produced is likely to cause a certain amount of trouble, though not of an especially serious nature. Whenever a fabric is produced which has a more or less staple sale, and where it is expected to operate looms continuously in the production, it is a paying proposition to advertise the fabrics and create a demand for them. It is certain that to-day there are very few lines which can be successfully distributed unless this method is taken.

It is possible to sell a certain amount of cloth of a staple nature without advertising, but this amount will be neither regular nor will it be large enough to supply the looms with orders. Sometimes the amounts expended for advertising purposes appear large, but when they are distributed over the whole cloth production they are often of a negligible quantity. In certain instances it has been positively proven that lower quality goods can be sold successfully when they are sufficiently advertised.



PATTERN—COLORS.

		40 ×													
30/1 Am. carded warp brown		2/2	12	2/2		2		2		2/2	12	2/2		=	980
30/1 Am. carded warp white	2/6				6		2/12		6				2/6	=	1,464
															2,444 total ends.

PATTERN—BEAMS.

		40 ×							
30/1 Am. carded warp. Beam 1.	2/6	28		8	20	2/6	=	1,484	Beam 1.
30/1 Am. carded warp. Beam 2.			2/12				=	960	Beam 2.
								2,444	

40/1 Am. carded filling, white; 60 picks.
29 reed, 30 5-6" width in reed, 28" finished width.
87 × 60 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
30/1 Am. carded white, 1 1/16" staple; 6 hank dou. rov.,	13¾c.	11c.	=	24¾c.
30/1 Am. carded colored, 1 1/16" staple; 6 hank dou. rov.,	13¾c.	16½c.	=	30¼c.
40/1 Am. carded white, 1⅛" staple; 8½ hank dou. rov.,	14½c.	13¾c.	=	28¼c.

COST.

980 ends 30/1 Am. carded brown + 6% take-up = .0414 @ 30¼c.	=	$ .0126
504 ends 30/1 Am. carded white + 6% take-up = .0213 @ 24¾c.	=	.0053
960 ends 30/1 Am. carded white + 29% take-up = .0537 @ 24¾c.	=	0133
60 picks 40/1 Am. carded white = .0551 @ 28¼c.	=	.0156
Weaving		.0105
Expenses		.0138
		$ .0711
Finishing, etc.		.0040
		$ .0751
Selling		.0037
		$ .078?
Commission price		.0925
Jobber's price		.1050
Retail price		.1500

Yards per pound, 5.83.

It is not an especially good policy to advertise goods and sell them because they are cheaper, and contain less value than others, but the instance shows how much influence advertising has in the distribution of fabrics such as that considered. There is no great difficulty in obtaining the weights of the various yarns used together with the weight of the cloth. The methods employed are exactly the same as for any ordinary fabric, the main item of importance being to obtain accurately the take-ups on the warp yarns. In the fabric analyzed the take-up on the crinkle portion was 29 per cent, or 23 per cent more than the ground cloth. The results are obtained as follows:

980 ends ÷ (30/1 × 840) = .0389, weight of brown warp without take-up.
6% take-up in weaving.
.0389 ÷ .94 = .0414, total weight of brown warp per woven yard.
504 ends ÷ (30/1 × 840) = .0200, weight of white ground warp without take-up.
6% take-up in weaving.
.0200 ÷ .94 = .0213, total weight of white ground warp per woven yard.
960 ends ÷ (30/1 × 840) = .0381, weight of crinkle warp without take-up.
29% take-up in weaving.
.0381 ÷ .71 = .0537, total weight of crinkle white warp.

$$\frac{60 \text{ picks} \times 30\ 5\text{-}6'' \text{ width in reed} \times 36''}{36''} = 1{,}850$$

yards of filling per yard of cloth.
1,850 ÷ (40/1 × 840) = .0551, total weight of filling per yard of cloth.
.0414 + .0213 + .0537 + .0551 = .1715, total weight per yard.
1.0000 ÷ .1715 = 5.83 yards per pound.

IMITATION JACQUARD BEDFORD CORD.

The most interesting question at present among domestic manufacturers is in connection with the importation of cotton cloth under the new tariff law. Possibly the facts in regard to this matter on one particular cloth may be of interest, and will show to a large extent just why fabrics are imported and what must be done if domestic sellers are to forestall any greater amount of importation than has been noted in the past. It may as well be recognized by domestic sellers now as in the future, that fancy fabrics have come to stay and that machinery and methods may as well be adapted to the production of such fabrics when a large profit is obtainable as when there is a greater amount of competition and fewer opportunities for large returns. As fabrics become more intricate, either because of their composition or weave, it requires a greater amount of labor to satisfactorily produce them, and for this reason domestic manufacturers have, to a certain extent, avoided their production.

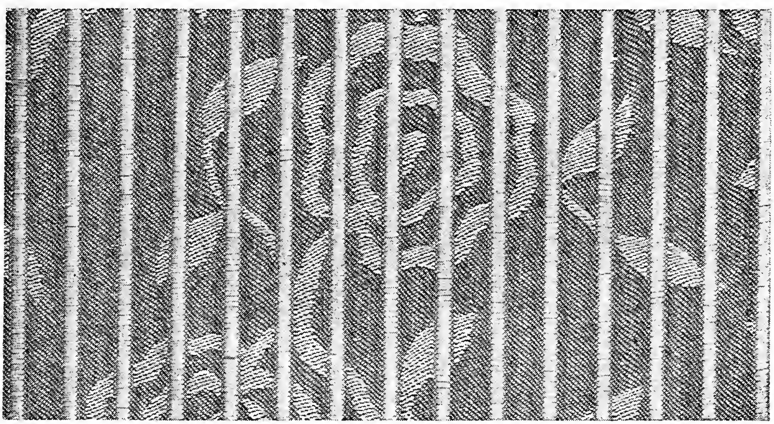
It has always been the policy to have weavers operate as many looms as possible, and to-day, if many more fancy fabrics be attempted, there would be a great deal of trouble with operatives and fewer looms per weaver would have to be run. Naturally, this would create a greater weaving price per yard, but the main difficulty would arise from the fact that enough weavers would not be available to operate the looms. There are what might be considered

RADICAL DIFFERENCES

between the domestic and foreign method of producing many cloths. This arises from the machinery which is used to a large extent, although there are other conditions which have an influence. In the first place, the foreign manufacturer has a large percentage of mule spindles in his equipment, the percentage being about 80, while the domestic manufacturer has about 80 per cent of ring spindles with only 20 per cent mule spindles. Because of the above condition, it is possible to make soft twist yarns and use a comparatively short staple of cotton for any certain size, while in the domestic market, in order to get a satisfactory production, a longer staple and a higher standard of twist must be used. The standard for warp yarn composed of American cotton is from 3.75 to 4 times the square root of the yarn size in English plants, while in American plants the standard is likely to be from 4.50 to 4.75 times the square root of the size.

The use of a short staple, together with a lower

standard of twist, does produce a soft yarn which answers satisfactorily in foreign mills, where a comparatively few looms per weaver are operated, but in domestic mills such yarn would not be at all desirable, in fact, could not be used in many instances. The various methods of making yarn result in fabrics of a somewhat different character, for the foreign cloth has a soft effect and a somewhat fuzzy nature, while the domestic cloth is more often smooth and clean, although of a much stronger character for the same size of yarn. For certain purposes, the hard fabric is desirable, but for most uses the softer material will take a better finish and have a much greater demand. Finish and style are of great importance to-day in the sale of any cloth, and on a mercerized fabric, such as that analyzed, is of importance in producing attractive results.



Imported Jacquard Novelty.

FOREIGN ADVANTAGE.

The foreign manufacturer has a much larger proportionate supply of jacquard looms than the domestic maker, and this fact permits him to produce a greater number of fancy materials. Of course, a larger number of jacquard looms in any plant will be responsible for a greater amount of detail, but when handled in a correct manner will also insure more extensive profit. One of the men considered of the highest standing in the domestic market stated during the past week that one of the things which must be done in the immediate future in domestic mills is to install a greater number of jacquard looms. He gave as his reason the fact that fancy fabrics have come to stay, and that even though as large figures as those used at present are not in demand, nevertheless jacquard looms produce better effects of a small character than dobbies. He also stated that there are any number of domestic mills which have dobby looms containing as high as twenty-five harnesses which never considered placing patterns upon such looms when they used over 16 harnesses, but rather adapted them to their jacquard machines. He said that although the loom speed was slower the percentage of production was often higher on jacquards and that the actual yardage obtained compared very favorably with that obtained from a dobby loom at a higher speed. A smaller percentage of seconds is

obtained when similar patterns are made on dobby and jacquard looms and it is often possible to weave yarn satisfactorily on a jacquard which could not be handled at all upon a dobby. The fact that foreign yarns are not so strong as domestic partly explains why foreign mills contain a greater number of jacquard looms.

MORE CO-OPERATION NEEDED.

The fabric to be considered is called a jacquard Bedford cord, but it is not a Bedford cord at all, for the cords are merely produced through the introduction of heavy yarns, though they do appear somewhat similar to certain of the so-called Russian cords which have been sold extensively. They are, however, not Russian cords, inasmuch as they are not produced by a leno motion. A fabric which is very similar to that analyzed, with the exception of the weave, has been sold quite extensively in the domestic market, the price being at retail 25 cents per yard as compared with 75 cents per yard for the jacquard woven imported article. The question arises whether this cloth could not or should not have been made in the domestic mills rather than to have been imported and made in foreign plants. It is a fact that converters are much in advance of domestic manufacturers in regard to style. Many of them would like to obtain a much greater range of styles than they do at present and would like to have many ideas worked out which domestic mills absolutely refuse to attempt. The method which has been used by domestic makers, namely that of quantity production, has warded off a large amount of progress in the making of fancy styles which might have been noted were a little more co-operation shown. It probably would be said that the quantity of the cloth considered which could be sold would be comparatively small. Even if this were true a large enough quantity could be sold to make a sufficient sized order for some domestic manufacturer. The

FOREIGN MAKER

will sell to any buyer eight pieces or 320 yards of any style and be entirely satisfied if no future orders are received. The domestic manufacturer will produce in most instances no fewer than 500 pieces or 30,000 yards of any fancy style, though in certain instances the amount can be reduced to approximately 250 to 300 pieces. There is absolutely no reason why the domestic manufacturer should not make orders of much smaller size than are now produced. If he believes that 250 or 500 pieces are necessary, why should this number of pieces not be produced with the same ground construction and possibly ten different designs applied to the cloth? A fabric such as that analyzed could be used as a ground work and different figures applied to it so as to make a range of styles which could compete with the small orders that foreign makers will produce. The only extra expense would be the cost of the design and the other details necessary in connection with it. For this cloth an extra design could be produced for a total cost of less than $10, and if only 1,000 yards of a pattern were produced this would only add one cent per yard to the cloth, a price which we feel certain many converters would be willing to pay if they could get the work done. Naturally, a greater designing force would have to be employed, but this is of small moment when the obtaining of a sufficient number of orders to run the plant in full is considered. Why should a fabric be imported when it can be produced and sold in a finished state at approximately 30 cents per yard with the foreign seller obtaining 42½ cents per yard? Domestic makers

MUST WAKE UP

if they expect to hold the business which they have had in the past. A difference of 12½ cents per yard in favor of domestic makers, and still have foreign sellers obtain the business, shows that there is something radically wrong either with the methods used for selling, in the style used in the fabric, or else the cloth appears 12½ cents better than a domestic fabric of a similar character. There may be some difference between a domestic production and a

foreign production such as that considered, but it is not 12½ cents per yard in any case. There is no reason why jacquard styles should not have been applied to the plain corded fabrics which have been sold for some time in the domestic market, and it is believed that the reticence of domestic manufacturers has been mainly responsible for the cloth importation. Of course, it may be that most of the jacquard looms in the domestic market have been busy at a good profit and that this has allowed foreign fabrics to be sold, but from observation in other years, this condition has little influence, because jacquard looms have been idle and fabrics which they could produce have been imported at the same time. Style is of much more importance than formerly, it being largely weave or finish, and these two features must be watched carefully by domestic producers.

A very poorly constructed fabric which contains an attractive pattern or is finished well will sometimes sell in competition with a better made cloth upon which a poor design or an unattractive finish is used. There has been altogether too much emphasis placed upon ordinary fabrics in the domestic market and not enough importance attached to the making of attractive patterns. The domestic manufacturer thinks only of quantity production, and this influences him in the making of designs as well as in the actual cloth production, so that many of the unimportant details are slighted and the result produced when the cloth is woven is not nearly as desirable as it otherwise would be. Many domestic fabrics have been rendered undesirable because enough care has not been used in making the design, whereas if quantity of production had not been so important the cloth would undoubtedly have been sold in quite sizable quantities.

There are a number of features in regard to the fabric under discussion which are worthy of mention. In the first place the ground cloth has been so constructed that it is quite firm and will give desirable service. The ground weave is not plain, but it is a three-harness twill, with the warp weaving on the face for two picks and on the back for one pick. Through this construction a larger number of picks per inch are possible and this causes the filling to cover up almost entirely the cords in the cloth and making a much better effect than would otherwise be possible. The filling passes over the cords two picks out of every three and the ground weave in the cloth makes it possible to bind down the filling as it comes over the cord and creates a clean effect which is not possible when a plain ground weave is used. It will be noted that the jacquard figure is cut off just before the cord is reached and this creates a better effect and in no way detracts from the general appearance of the fabric. We do not consider that the pattern which is used on this cloth is especially attractive for dress goods, but nevertheless the idea is ingenious and could be used with somewhat better results if other styles of figures were employed. The high ground construction and the weave which is used would also make it possible for other effects, both warp and filling, to be introduced, and inasmuch as the ground fabric is selling quite well in the domestic market it would seem desirable for domestic manufacturers to attempt styles of somewhat similar character. Most

FOREIGN FABRICS

are of a wide nature, especially the crepes and ratinés which have been selling recently, but these fabrics are of narrow construction, namely 28 inches in the finished state and could be produced by almost any mill in which jacquards are available in the domestic market. It might be mentioned that the cords are six-ply yarn instead of being coarser ply which are often used in domestic fabrics of a somewhat similar character. The use of a heavy ply yarn in this instance probably creates a smoother effect and a more regular width of cord, and for this reason is desirable; in

fact, the whole fabric shows that intelligence has been used in its production. Most domestic sellers know that cords of this character have been desirable, but few of them have attempted to make a cloth of as good quality as that considered. The better constructed a fabric of this character is the finer will be its appearance and the effect more like that of a Russian cord. There is not one buyer in a hundred who would know or care whether this cord was made by a leno motion or in some other manner, because it looks just about as well as it would if it were made by the leno attachment. It is also probable that a cord produced in a manner similar to that in the cloth analyzed is more satisfactory than a Russian cord, inasmuch as it is not so hard and combines better with the whole cloth appearance. The making of designs for fabrics of this character is a

VERY SIMPLE PROCESS,

and can be accomplished in a comparatively short time. In some cases it is necessary to paint in the ground weave entirely if a design paper is not available which has the weave upon it, and in a fabric like the sample the use of cords makes it almost always necessary. If there be a much higher tie-up in the machine than is used in the cloth it is a good plan to watch the places where the jacquard hooks are to be cast out, and usually it is a good plan to cast them out where the cloth count is the lowest. In regard to the manufacturer's profit, it is a good thing to base this upon the number of picks which the cloth contains or the actual yardage which is produced. To compare a cloth of 114 picks per inch with one which contains 72 picks per inch is not justifiable, inasmuch as a greater amount of profit should be obtained for the cloth containing the larger amount of picks per inch.

In order to obtain a satisfactory gain it would probably be necessary for a manufacturer to obtain at least 3 cents per yard profit, as this amount would allow somewhat less than $3 per loom per week to be received, and would return a profit of only about 12 per cent upon the capital necessary to produce such material. The price for finishing a fabric of this character is not especially high in the domestic market, and for many such styles the price would be from 1½ to 1¾ cents per yard. The

EXPENSES OF A CONVERTER

in selling are higher than for the more staple materials, but in any case, they do not add enough to the cost of the materials to make the sale of it prohibitive when compared to the imported material. Without doubt a domestic fabric of approximately the same character as that considered could be sold at retail in the domestic market for about 45 cents per yard, although we have mentioned 50 cents as the retail selling price in the fabric analysis. Allowing a very good rate of profit to the different sellers, the domestic price of 30 cents or less compares favorably with the price in England of about 27½ cents. It may be well to note that the yarns are finer in the cloth in a finished state than they are when spun. The warp yarn sizes about 44-1, whereas probably 40-1 was used originally. The same condition is noted in regard to the other yarns, and the filling which probably was 35-1 when spun sizes somewhat over 37-1 in the finished material. We have used Egyptian cotton in our estimate of yarn costs for the filling, inasmuch as this cotton gives somewhat better results, although domestic makers have avoided its use recently in their fabrics which are to be piece mercerized.

Such fabri s as those analyzed should not be imported, but rather made in the domestic market, and unless care be exercised there will be a great deal more of such cloth imported than there has been in the past. It is up to manufacturers to see that this does not occur. The method of obtaining cloth and yarn weights is as follows:

1,980 ends ÷ (40/1 × 840) = .0589, weight of 40/1 warp without take-up.
9% take-up in weaving.
.0589 ÷ .91 = .0647, total weight of 40/1 warp per woven yard.
294 ends ÷ (26/6 × 840) = .0808, weight of 26/6 warp without take-up.
2% take-up in weaving.
.0808 ÷ .98 = .0824, total weight of 26/6 warp per woven yard.
80 ends ÷ (40/2 × 840) = .0048, weight of 40/2 warp without take-up.
6% take-up in weaving.
.0048 ÷ .94 = .0051, total weight of 40/2 warp per woven yard.

$$\frac{114 \text{ picks} \times 31\tfrac{1}{4}'' \times 36''}{36''} = 3{,}562.5 \text{ yards of}$$

filling per yard of cloth.
3,562.5 ÷ (35/1 × 840) = .1212, total weight of 35/1 per woven yard.
.0647 + .0824 + .0051 + .1212 = .2734, total weight per yard.
1.0000 ÷ .2734 = 3.66 yards per pound.

PATTERN.

40/1 Am. combed colored...		20		20		= 1,980 B 1
26/6 Am. carded			3			= 294 B 2
	2				2	
40/2 Am combed	20				20	= 80 B 3
		98 ×				2,354 total ends.

35/1 Eg. combed filling; 114 picks.
42 reed, 31¼" width in reed, 28" finished.
84 × 114 all over count.

YARNS.

	Cotton.	Labor, waste, dyeing, etc.		
40/1 Am. combed; 1⅛" staple; 8 hank dou. rov.,	16½c.	34¼c.	=	50¾c.
26/6 Am. carded; 1$\frac{1}{16}$" staple; 5¼ hank dou. rov.,	15c.	9¾c.	=	24¾c.
40/2 Am. combed; 1⅛" staple; 8 hank dou. rov.,	16½c.	14¼c.	=	30¾c.
35/1 Eg. combed; 1⅜" staple; 8 hank dou. rov.,	22c.	11½c.	=	33½c.

COST.

1,980 ends 40/1 Am. combed warp + 9% take-up..........	= .0647 @ 50¾c.	=	$ .0329
294 ends 26/6 Am. carded warp + 2% take-up..........	= .0824 @ 24¾c.	=	.0204
80 ends 40/2 Am. combed warp + 6% take-up..........	= .0051 @ 30¾c.	=	.0016
114 picks 35/1 Eg. combed filling	= .1212 @ 33½c.	=	.0406
Weaving			.0306
Expenses			.0293
			$ .1554
Jacquard cards			.0031
			$ .1585
Selling (grey)..			.0032
Mill cost			$ .1617
Mill selling price (about)................................			.1925
Bleaching, mercerizing, etc.			.0175
Converter's expenses			.0250
Converter's cost			$ .2350
Converter's selling price (about)........................			.3000
When sold direct, retail price should not be over..............			.5000
Yards per pound 3.66.			

Details regarding imported cloth:
Selling price in England (about)..............................27.5c. per yard
Rate of duty 30%.
Selling price of importer in United States.......................42.5c. per yard
Selling price of retailer ....75c. per yard

AN IDEA OF VALUE

Probably the one feature in cotton cloth making and selling which is largely responsible for satisfactory profits is the use of ideas which are stylish and new, that is, ones which are somewhat different from those the majority of makers are producing. Such results may be obtained through a change in cloth construction or the application of a different finish. The process does not necessarily mean that the cost of making or finishing will be higher; in fact, it has quite often happened that more desirable effects are obtained at a lower cost, though, because of domestic producing methods, a change to a higher count is often more necessary than a change to a lower count, with the result of increasing cost. The fact that prices are watched so carefully is very detrimental to the best result being obtained, and many times the construction which appears well is cut down to such an extent that the original effect is well-nigh lost.

It would be far better if sellers of

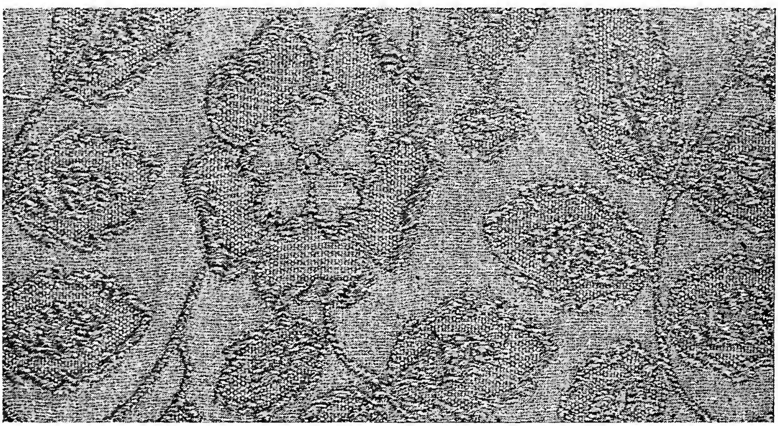
exclusive fabrics would use the cloth construction which they find will produce the best result regardless of its cost, within reasonable limits, and let others adopt the practices which are so generally noted. A better profit would ultimately be secured, and in addition a reputation for quality would be built up, a process which is especially difficult to-day. How many are there, even among cloth makers, who realize the small difference in cost which there is between a good article and a poor one of the same character? Usually it is a question of a little better stock, a little better yarn, a few more threads or picks per inch or an arrangement of fabric pattern in a more artistic manner, all of which changes are immaterial in many cloths when the prices to consumers are considered.

It is undoubtedly true that a good many foreign manufacturers have a certain amount of advantage over domestic producers, inasmuch as they are not bound to such an extent to the set price limit, and in addition their methods of production admit of a

GREATER VARIATION

in production. Under these conditions it may be well to consider a fabric which contains a number of ideas that can be adopted with success by domestic producers.

One of the most certain features in the market at present is that crepes and crepe effects will be the best, or at least one of the best, sellers for the coming spring and summer. Many of such effects have been made and sold, not only in plain shades and in printed patterns, but also decorated with various kinds of stripes and checks. The light character of the majority of crepe cloths is of advantage in many ways, allowing soft, clinging garments to be produced, and making strong contrasts possible in the fabric construction. To produce the desirable materials, comparatively fine yarns are necessary, and in order to allow sufficient shrinkage, which produces the crepe effect, a rather low cloth count is employed. Fine yarns and a



A Novelty Fabric of Unusual Interest Showing Jacquard Weave on Crepe Cloth.

small number of threads of picks per inch make woven figures undesirable, and very few are employed on crepes except on stripes or on portions of the cloth which are unlike the ground.

Jacquard figures have been selling extensively, but no one, so far as we know in the domestic market has produced a desirable crepe cloth which has jacquard figures woven upon it. That this can be done successfully is

shown by the fabric analyzed, but a great deal of ingenuity is necessary in order to make such effects practical. In the first place the woven fabric would appear to many as being a double cloth, but this is not the case. The weave which has been employed in the ground fabric should be evident from an examination of the illustration that we present, which is one repeat of the ground weave, so far as the number of picks in the weave is concerned. The cloth is woven on a box loom and contains two picks of hard twist face yarn and two picks of mercerized yarn, which in the ground fabric show only on the back of the cloth. On the

HARD TWIST PICKS

the weave is entirely plain, except where the figure is being produced, while on the mercerized yarn an eight-harness warp satin weave is employed.

There is this point to be noted, however, and it is that the warp depression, when the mercerized picks are inserted, occurs on the same threads as it does on the hard twist pick, and allows the heavy mercerized yarn to slip in behind the hard twist face yarn and be noticeable only on the back of the cloth. This can be seen easily from an examination of the ground weave. Only through this method would it be possible for the face of the cloth to appear so free from mercerized yarn. A good many manufacturers would not use a correct weave on the back yarn, and satisfactory results would not be obtained. Comparatively few domestic cotton cloth makers have any equipment of jacquard box looms, and some of those who do would not use such looms on jacquard box loom work, but it would be of advantage if they kept in more careful touch with styles, and brought out as desirable effects as the one considered.

That this fabric can be sold at 62½ cents per yard by an importer and at $1.50 per yard by a retailer, when it can be made and sold at a very much lower price by the domestic manufacturer, shows clearly that the domestic manufacturer lacks very much to being the unqualified success which he should be in the making of novelty materials. A large item in the success of any producer of any material is to get out new ideas in advance of one's competitor. Wearing value is of greater importance in staple line, but it is largely style which is responsible for satisfactory profits on fancies. In certain kinds of silk fabrics what are called blister effects are now selling especially well, though at comparatively high prices, and while there has been none of these effects produced entirely from cotton yarns, nevertheless the cloth analyzed shows an effect of this character.

The hard twist of the face yarn causes the cloth to shrink quite a little when it is finished, though not to so great an extent as if the heavy back yarn were not present. Where the

MERCERIZED YARN

creates the figures on the face of the cloth this shrinkage causes a slight curvature, and raises the figure somewhat. With a double cloth construction similar to that considered, we believe that blister effects could be produced which would be very attractive and entirely different from the fabrics now being offered, and because of the present style ought to be sold extensively. Of course, the cost of production would be high, but nearly always profits warrant the procedure if care is used in making the weave correctly. The trouble has been that the quantity of production demanded by a domestic maker has affected design work as well as fabrics, and the fine points which cause a fabric to be desirable or otherwise are often overlooked.

To make the blisters or figures appear more prominent on the cloth considered, the hard twist filling is allowed to float on the back of the cloth, and this fact allows the hard twist yarn to shrink up to a greater extent, inasmuch as it is not held so tightly by being bound into the fabric. A great deal of ingenuity has been used in making the design in addition to the points mentioned, for both the heavy and light yarns are combined in such a manner that there are no streaks in the fabric when the weave changes occur. A portion of the weave inside of the figure is somewhat

similar to an ordinary basket weave, but it has been manipulated in such a manner that the heavy and light yarns do not appear radically different when inserted by the box motion. The fact that the mercerized yarn absorbs a somewhat greater amount of color than the hard twist yarn, the method of producing the figure and effects are well worth the attention on the part of the manufacturers. Taken all together, we believe that there are very few plants where a fabric of this character would be so satisfactorily worked out.

There are certain features in the making of

HIGH-CLASS FABRICS

which must be considered carefully if the correct profit for each cloth is to be secured. Take the cloth under consideration as an example. There are 124 picks per inch in the cloth, in a finished state, and while a manufacturer would realize it, nevertheless there are many others who would not consider the fact that this cloth would be produced at a very slow rate of speed. This is partly because the loom operates at a much slower speed than many dobby looms, and also because of the larger number of picks per inch. When the yards produced are small, the weaving price per yard will increase, and the expenses per yard will also advance a relative amount. This, of course, should be noted when the cost of the goods is being secured, but the same items should be considered in ascertaining the amount of profit per yard which would be satisfactory.

It is not correct to expect to obtain the same amount of profit per yard for a fabric such as that analyzed with 124 picks per inch as it is for a fabric similar to the ordinary jacquard shirtings which may contain somewhere in the vicinity of 80 picks. The profit per yard should be dependent to a large extent upon the yards which the loom produces, though there are other features which would have an influence. In this cloth we have considered that the jacquard cards are included in the item mentioned as expenses. The number of cards which are employed, the amount of cloth which they weave and other features have an influence on the cost of this item, but for a similar fabric produced in a domestic plant the cost of the jacquard cards would add an amount of approximately one-half a cent per yard. This occurs because there are quite a number of cards necessary to produce the design, a fact which is not noticed in most domestic cotton fabrics.

In order to secure a satisfactory profit upon the capital required to produce these goods, and to make it worth while to develop ideas which are new, the profit per yard necessary would be from three and one-half to four cents a yard. A good many

DOMESTIC MANUFACTURERS

figure to make about $2 a loom per week on their dobbies and some of their jacquard work when the demand is not especially pressing, and a greater amount should be secured from the production of cloths such as described.

The yarns used in the making of this fabric do not warrant any large amount of description, but they are of some interest. The warp yarn, if produced in a domestic plant, would be made of about one and one-quarter inch staple, and it would be all of the same character, both selvages and the main portion of the warp. Many foreign fabrics and some domestic, especially where dyed and bleached yarns are used, have a certain kind of yarn for their selvages, no variation being made when the construction of the cloth is changed. Foreign manufacturers undoubtedly would use a shorter staple of cotton than that mentioned, but we have considered in our analysis the fabric as it would be produced in a domestic plant. The hard twist filling is somewhat similar to the yarn employed in ordinary crepes, the standard of twist varying from six and one-half to eight and one-half times the square root of the yarn number. It is often necessary to use a little finer size of roving for a certain size of yarn than would be the case if hard twist were not being produced.

In many cases we have seen yarns shrink approximately 10 per cent in

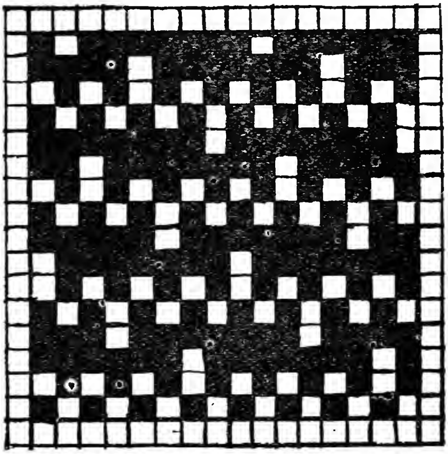
the spinning process, when extra twist was applied. In order to satisfa torily use this hard twist yarn in the weaving operation it must be steamed or heated in a like manner in order to set the twist and eliminate the kinking. The mercerized yarn is similar to any yarn of this character. We have considered that the stock used was Egyptian, inasmuch as this produces somewhat better results. Two-ply yarn has been used because the fabric is not piece-mercerized, but rather the yarn is mercerized before being woven, and in most instances it is not practical to mercerize soft twist single yarn, although it has been done to an extent. The mercerized two-ply yarn undoubtedly will cause the fabric figures to fray less than if a mercerized single yarn was used.

THE CLOTH CONSTRUCTION

and results produced are of greatest interest to cloth makers and those who develop constructions, but to a distributor who does not understand these figures it probably is true that the selling prices are of greater interest. To one who does not consider the matter carefully the price in the foreign market and the price in the domestic market would seem to preclude any possibility of the cloth being sold by an importer. Note that this cloth could be made and sold by a firm which sells direct to the retailer, at about 34 cents per yard, while the price in the foreign market would be from 35 to 37 cents per yard. Under domestic scheaules for selling, the cloth could be sold so as to retail at about 50 cents per yard, while if it is imported it cannot be sold at less than $1 per yard, or in this vicinity. This same condition is noted on a great many cloths which are imported and sold to-day, and when their costs of production are compared there is a decided advantage in favor of domestic producers.

The fact that fabrics are sold shows that other features often have a greater influence than the cost of production. Perhaps, the reason why this cloth can be sold is because there are new ideas involved which domestic producers have not yet adopted. It probably is not true that the quantity sold is so small that it would be of little interest to domestic producers, in other words, the fabric style has made the sale possible, or else the buyer has not been fully enough acquainted with what domestic producers can supply. Very many of the fabrics which have been imported are imported because they show desirable features rather than because they can be sold at a lower cost than will be observed in a domestic plant. The only way domestic sellers can prohibit the importation of a good many cloths is to get busy and produce attractive ideas just as quickly as foreign sellers.

In addition, there is one point which



Weave Plan.

should be mentioned, and this is that domestic sellers do not acquaint buyers with the styles which they can produce in a general manner.

Foreign selling conditions make this problem somewhat easier than it is in the domestic market, besides the production of fancy fabrics is an older business, and the styles which various mills can produce are better known, but there should be some method by which buyers will become more familiar with the styles which domestic mills can produce. Domestic buyers depend to a great

extent upon the cloth broker as to where a cloth can be obtained, but this method has its failings, though it must be said it is not due to inability upon the part of the cloth broker, but rather a lack of knowledge on the part of the buyer, inasmuch as foreign fabrics are often purchased when they could be obtained at a lower price from a domestic seller.

As long as there is a difference in selling price in favor of domestic manufacturers, and this appears to be the general condition upon many of the fabrics which we have investigated, it would seem as if domestic sellers would make a greater effort to produce the exclusive styles which foreign sellers manage to distribute. There undoubtedly has been a great amount of progress in the style of domestic fabrics, and often identical fabrics are being sold, both imported and domestic, whereas if a domestic seller had been closer to buyers, and they had been more familiar with his styles, the importation of the cloth would not have been possible. The method of obtaining the yarn weights and the weight of the cloth is as follows:

3,192 ends ÷ (50/1 × 840) = .0760 weight of warp without take-up.
10% take-up in weaving.
.0760 ÷ .9 = .0844, total weight of warp per woven yard.

$$\frac{62 \text{ picks} \times 31\ 2\text{-}3'' \text{ reed width} \times 36''}{36''} = 1,963$$

yards of filling per yard.
1,963 ÷ (840 × 45/1) = .0519, weight of hard twist filling.
1,963 ÷ (840 × 26/2) = .1798 weight of mercerized filling.
.0844 + .0519 + .1798 = .3161, total weight per yard.
1.0000 ÷ .3161 = 3.16 yards per pound.

PATTERN.

50/1 Am. combed warp $\frac{2}{16}$ 3,128 $\frac{2}{16}$ = 3,192 total ends.
45/1 Am. combed filling, hard twist 2 } 124 total picks.
26/2 Eg. combed filling, mercerized 2 }
50 reed, 31 2-3" width in reed, 27¾" finished width.
115 × 124 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
50/1 Am. combed warp; 1¼" staple; 10 hank dou. rov.,	19½c.	16c.	=	35½c.
45/1 Am. combed, H. T.; 1⅛" staple; 10 hank dou. rov.,	17c.	21c.	=	38c.
26/2 Eg. combed; 1⅜" staple; 5½ hank dou. rov.,	22c.	19½c.	=	41½c.

COST.

3,192 ends 50/1 Am. combed warp + 10% take-up	= .0844 @ 35½c.	=	$ .0300
62 picks 45/1 Am. combed filling, hard twist	= .0519 @ 38c.	=	.0197
62 picks 26/2 Eg. combed filling, mercerized	= .1798 @ 41½c.	=	.0746
Weaving			.0376
Expenses			.0360
			$ .1979
Selling (grey)			.0040
Total mill cost (grey)			$ .2019
Mill selling price (about)			$ .2400
Bleaching, finishing, etc.			.0250
Converters expenses			.0225
Converters total cost			$ .2875
Converters selling price (about)			.3400
Retailers selling price			.5000

Yards per pound 3.16 (grey).

FIGURES FOR IMPORTED FABRIC.

English selling price (about)		$ .3750
Rate of duty	30%	
Importers selling price		.6250
Importing expenses	8%	
Retail price		$1.00

STRIPED TISSUE

A situation which has not been of especially great importance in the past, but which must be faced in the future, is the one which has developed rapidly during the past few years, and relates largely to the production of novelty fabrics which sell for comparatively high prices. In this connection, it may be well to take up a few of the features which distinguish domestic manufacturing from that of

foreign countries, to a certain extent. In the first place, foreign makers usually accomplish only one part in the production of a finished material, that is, a certain manufacturer will have a spinning plant and produce yarn for the market, another will purchase this yarn and weave it into various styles of cloth, while still another will finish the fabric in whatever manner seems most desirable at the time. Thus the industry, or a large portion of it is subdivided. This method is more suitable when a great variety of cloths are to be produced, inasmuch as it allows a greater flexibility in the organization and permits a manufacturer to go into business in a comparatively small way.

With the domestic industry, conditions are largely different, inasmuch as many plants are entirely complete, making the yarn, weaving the cloth and finishing it. This does not apply to many of the grey cloth mills whose material is finished in a different plant, due to the many finishes which are necessary, and also because of the great variety of fabrics produced. Because of the

METHOD OF MANUFACTURING,

it is not so possible for a plant to be started in a small way, and is of decided disadvantage where novelty cloths are to be produced. The domestic manufacturer has used every effort to build up the business for quantity production, and while this is of great advantage in keeping down costs, it does not allow style to become of as great importance as it otherwise would. Thus, in the foreign market it is possible for a buyer to obtain as small a quantity as eight pieces or 320 yards of any ordinary fancy fabric, while it usually is not possible in the domestic market for a purchaser to secure any fewer than 300 pieces or 18,000 yards. Possibly in the majority of cases the smallest amount of fancy cloth which a domestic manufacturer will sell is 500 pieces or about 30,000 yards. This statement, of course, refers to the ordinary fancy fabric known as grey cloth.

That there is a large field developing in which novelty cloths are in demand is recognized by those who handle fancy cloths, but the industry is so organized that there is small opportunity of attempting such production. A buyer may be able to distribute from 10 to 50 pieces of fancy cloth at almost any price which might be named, whereas it would be absolutely impossible for him to dispose of from 300 to 500 pieces, the normal quantity demanded by a domestic producer. This is one of the important features which must be considered in regard to fabric importations, for quantity enters into the consideration as well as price. Then, there is the question of style. A good many purchasers desire to handle fabrics which they are absolutely certain others are not offering, and often are willing to pay a higher price to obtain small quantities of novelty cloth. Whether such cloth is better than that which others are offering at a relative price is not considered at all, but rather the fact that they can place large emphasis upon the exclusiveness of the cloths they have for sale.

One of the great reasons why this kind of manufacturing has not developed in the domestic market is through a lack of ability in cloth making and styling. In order to successfully produce high-class fabrics a great deal of ability and ingenuity are required, and not only this but a producer must be familiar to a greater or less extent with the various kinds of textile fibres and their combinations. Foreign manufacturers of this character use cotton, wool and silk freely in their productions, and in order to get the best results experience is necessary. The domestic industry has grown so fast that there absolutely is not a sufficient number of expert men to operate all of the present plants in a fairly economical manner. For any man who is capable of going into a small business, such as the making of high-class, exclusive fabrics, there is a much larger opportunity in running some of the mills which are not especially successful to-day, and the recompense is undoubtedly greater than could be made

from the operation of a small plant with little capital. This is

NOT ALWAYS THE CASE,

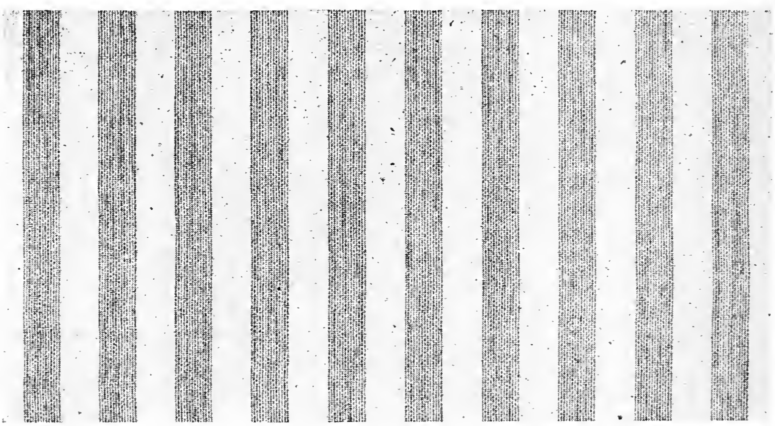
inasmuch as certain small plants on novelty fabrics do make very large profits, but it is generally true. It is also a fact that anyone who makes novelty cloths in the domestic market will have to get off from the beaten track, and this causes fear and trembling among those who are not possessed of a large amount of ability in overcoming difficult situations. There is one thing certain, and this is that it will never be a practical thing to produce certain of the high-class fabrics in the domestic mills as they are now organized, inasmuch as the detail is so great that it would upset the processes and cause large increases in cost on other fabrics which are not justified. To make such a business successful it must be run in a small way, and one man must be in much more intimate touch with everything in the operation of the plant than can ever happen in most of the domestic concerns.

Judging from the industry as now operated, it would seem as if the making of many of the exclusive fabrics was prohibited, and although this is true to an extent, there is every opportunity in the world for the building of small plants in which expensive cloths are to be made. We believe that this will be the next step in the development of the domestic industry, and the ones who successfully work out the problem will undoubtedly obtain large rewards in comparison with the capital necessary for operation. The large plant is equipped to make staples, although there are many fancy fabrics which come in this classification, but for the new expensive materials which sell, especially because of style, there must be a new development with small units as a basis.

The fabric which we are to consider, and which is illustrated by the garment here presented, is one of the cloths that can be produced in a small way, but which shows quite a

HIGH RANGE OF PROFIT

to the maker. It is not always expensive fabrics that contain complicated weaves, although a good many of them do at present. The fabric considered is only a plain weave cloth, and it is the combination of fibres and colors which makes it attractive. A short time ago, voiles were in good demand, enormous quantities having been produced, and although these materials were desirable



Striped Tissue.

the quantity produced was such that a change in demand occurred. This change, however, did not eliminate certain of the fabrics or ideas which are used in the production of voiles, and it is likely that many somewhat similar fabrics will be continually in use; in fact, prominent sellers predicted that voiles would be absolutely worthless the present year. Nevertheless certain mills have had quite a quantity of orders on these very cloths and undoubtedly will another season. This will occur because the fabric seems more desirable than other materials for certain uses, and some people will not consider that the fabric is not especially stylish, but rather that it is attractive. A certain amount of voile cloths are being made in a low quality and sold at a reduced price, but they represent in no way the fabrics which will have a continual demand. There are

CERTAIN FEATURES

in the cloth analyzed which are worth mentioning. The first is that the warp is exactly similar to that in an ordinary colored yarn voile cloth. The count is rather low, just the same as for a voile, and the yarns are made in a manner somewhat alike. Naturally, the use of bleached and dyed yarns causes a greater amount of labor and a higher expense than if a grey yarn voile were being produced, but this is a manufacturing feature, and there is no great difficulty in the method of producing. Ordinary voiles are of rather light weight, but in most instances they are not firm, and in certain cloths firmness is rather desirable. If any greater number of picks than are used in an ordinary voile cloth be introduced, the firmness will be increased, but the desirable openwork effect will be largely lost. To make a light-weight effect and still have a firm fabric there has been used for filling a silk yarn. This silk yarn makes a light fabric, but does not detract at all from the voile effect. An ordinary silk yarn when reeled is full of gum, the amount varying somewhat, due to different conditions. Silk under this condition is not very lustrous, although it is smooth and much finer than most cotton yarns. The luster appears when the yarn is boiled out and the gum either partially or wholly removed.

In order to make the crisp

VOILE EFFECT

and have no luster, this fabric has been woven with silk which has not been degummed. This is not a general practice, but it shows how various fibres and ideas must be combined in order to produce certain effects which seem desirable at any time. There is some advantage in using a fine silk which is not lustrous for filling yarns, as it allows warp stripes to be more prominent. In the fabric under discussion the colored stripes appear almost as if they had been printed, a process in which the fibres are entirely covered with color on the face. If ordinary white filling had been used, the colored stripe would have been practically half white, thereby creating a somewhat different effect, and if the filling had been entirely colored, one stripe would have been of a solid color, while the white stripe would have been practically half colored. The practice of using a silk which is not degummed is sometimes adopted in making very light fabrics in which luster is undesirable.

Sometimes a silk warp is used with cotton filling and at other times a cotton warp is used with a silk filling. The fact that the silk contains gum gives the fabric a rather crisp feel, and the material is usually printed with all-over patterns of various kinds. Such printed patterns do not often appear well on heavier fabrics, and the reason why silk is used is to make a very light material with better results. We have explained at various times the features of interest in the production of voile cloths; that is, that the yarn contains a standard of twist much higher than that of ordinary yarn, a standard which often varies from 6½ to 10 times the square root of the yarn number. This extra twist causes the yarn to contract quite a little and

makes the yardage per pound lower than it otherwise would be. It also makes the yarn much weaker than it normally is, and due to the large amount of twist, a steaming or sizing process must be adopted to eliminate the kinking up of the yarn. Yarns which are used in voiles must be made of good cotton and spun well to give the best results. This may be observed through the fact that certain makers have had large orders for voile cloths during recent years, while others have never been able to obtain as large orders or as satisfactory prices. Often yarns which are used in voiles are gassed, a process by which projecting fibres are removed, making the yarn like small rods. Sometimes voile cloths are piece mercerized, this process giving a certain amount of luster which makes the material more desirable, although it does not produce a luster to compare with that in a yarn which contains what is called soft twist.

Many of the fabrics which are made in cotton mills and which contain silk are under the new tariff classified in the "silk schedule," and obtain comparatively high rates of protection, allowing a great many of them to be made satisfactorily in domestic mills. Take the fabric under discussion. Without doubt upon the lowest cost in a foreign mill the domestic maker would obtain far more protection than his entire cost of manufacturing, excluding the material. This occurs through the proportion of silk used in the fabric making. Most of the silk and cotton fabrics produced in cotton mills are thus

HIGHLY PROTECTED,

and few of such fabrics can be imported unless the foreign maker plans the material to be in chief value of cotton, which allows only a comparatively small amount of silk to be used. Fabrics of a novelty character can often be sold direct to large retailers, or in any case, more direct than those which are made in larger quantities, and the advance in price sometimes does not appear so great as it does on other lines of fabrics. Take ordinary silk cloths such as are produced in large quantities. It often happens that a cloth which costs about 60 cents to manufacture is retailed at $1.25 regularly or even less. This is only about 100 per cent advance on the cost of making. Possibly the majority of fancy cotton cloths show an advance of anywhere from 250 to 300 per cent; and many of them as much as 500 per cent advance on the cost of making. There are very few of the high-class silk fabrics which show as great advances as fancy cotton fabrics do when the price to consumers and the cost of manufacturing is considered.

The domestic manufacturer of fancy fabrics produces them in a very efficient manner; in fact, it is doubted whether foreign makers can approach the costs of some of the domestic makers on a good many materials, but where the difference occurs is in the

COST OF DISTRIBUTION.

For a good many mills competition has forced prices to about as low a level as can occur and allow a sufficient margin of profit, and any further steps will force manufacturers to protect themselves and go into distributing their cloth themselves. This may not mean selling to the consumer direct, for such a method is not generally possible, but it does mean that manufacturers will adopt some method by which their fabrics will become known to consumers and whereby they will have something to say regarding the prices at which their materials are sold. If prices are not lowered their going into distribution will allow them to obtain certain of the large profits which are now obtained by others. The development of fancy cloth making in small quantities has yet to occur in the domestic market, but when it does occur the methods of distribution will be watched carefully and without doubt larger manufacturers will profit by them. The method of obtaining the yarn weights is as follows:

1,552 ends ÷ (100/2 × 840) = .0370, weight of white warp without take-up.

4% take-up in weaving.

.0370 ÷ .96 = .0385, total weight of white warp per yard of woven cloth.

1,470 ends ÷ (100/2 × 840) = .0350, weight of colored warp without take-up.

4% take-up in weaving.

.0350 ÷ .96 = .0365, total weight of colored warp per yard of woven cloth.

$$\frac{80 \text{ picks} \times 49\tfrac{1}{2}'' \text{ width in reed} \times 36''}{36''} = 3{,}960$$

yards of filling per yard of cloth.

3,960 ÷ 225,000 yards (silk) = .0176, total weight of filling per yard of woven cloth.

.0385 + .0365 + .0176 = .0926, total weight per yard.

1.0000 ÷ .0926 = 10.80 yards per lb.

PATTERN.

100/2 Sea Island combed white	48		14		48	=	1,552
100/2 Sea Island combed colored		14		14		=	1,470
		104 ×					3,022

18/20 silk filling; 80 picks per inch.
60 reed, 49½" width in reed, 47" finished width.
64 × 80 finished count.

YARNS.

	Cotton.	Labor, waste, twisting, dyeing, etc.		
100/2 S. I. combed white; 1⅝" staple; 20 hank dou. rov.,	28¼c.	59c.	=	87¼c.
100/2 S. I. combed colored; 1⅝" staple; 20 hank dou. rov.,	28¼c.	65c.	=	93¼c.
18/20 silk filling; 225,000 yards per lb. (ready for use)			=	$4.10

COST.

1,552 ends 100/2 Sea Island white + 4% take-up	= .0385	@	87¼c.	=	$ .0336
1,470 ends 100/2 Sea Island colored + 4% take-up	= .0365	@	93¼c.	=	.0341
80 picks 18/20 silk filling	= .0176	@	$4.10	=	.0722
Weaving					.0483
Expenses					.0252
					$ .2134
Finishing					.0075
					$ .2209
Selling					.0111
Mill cost					$ .2320

Plain weave.
Yards per pound 10.80.
Retail price $1 per yard.

ARTIFICIAL SILK NOVELTY DRESS GOODS

There is a greater amount of interest in fancy cloth making at present in regard to the possibilities in use of artificial silk than there is in about any other feature which makes cloth salable. The method of making and characteristics of artificial silk have been described in these columns quite extensively in the past, and there is little to be said as far as the cloth maker is concerned, inasmuch as he is interested in adapting this material to his fabrics rather than in the original production of the fibre. There are certain features which make artificial silk desirable in fabrics and there are other features which, from a manufacturing standpoint, make it rather undesirable.

Possibly the fact that it loses strength very extensively when moistened has been mentioned as prominently as any other characteristic, but the method which has been used by fabric makers in adapting this material to their cloths causes this item to be of comparatively small importance, in fact, so far as the ultimate consumer is concerned, the fibre might just about as well be artificial silk as the real article. Then there are disadvantages in the use of this material by a manufacturer. The fibre is quite slippery and rather stiff, in some instances being undesirable from such cause.

Then, it also is not made in as fine sizes as silk or if made, it is not a practical thing from the standpoint of most manufacturers. Because the yarn is of quite heavy size it is impossible to use it in certain fine fabrics, that is, the heavy yarn will not weave satisfactorily in a fine reed. The passing of the reed back and

forth causes the yarn to wear and it loses strength, thus causing breakages. This

FRAYING PROCESS

also causes fibres to be worn so that they project from the main strand of yarn and this is sometimes objectionable. There are very many fabrics, however, in which artificial silk in ordinary sizes can be used successfully. Everyone realizes that many cloths have been in demand which have had a rather low count, such as voiles, crepes, and various kinds of eponge cloths.

In these materials artificial silk has been used quite extensively and will be used in similar cloths much more so in the future. Recently, we were shown a cloth in which a double novelty yarn was used, one of the strands being a nub yarn composed entirely of artificial silk. The domestic manufacturer has to consider very seriously the fact that he cannot afford to use very much extra labor in his fabric making, even on the extreme novelties which are produced in the market. For this reason, it is impossible to use artificial silk in fabrics here as extensively as it is in foreign countries, but it is undoubtedly possible to use a much greater quantity than is at present noted. When a real silk is being used of a coarse size there are very many instances where an artificial silk could be substituted to advantage not only so far as the price is concerned, but also in regard to the ease of production.

VALUE OF SMALL DETAILS.

One of the great reasons why many foreign fancy fabrics appear better than domestic cloths of a similar character is because of the greater care used in cloth construction and in placing the weave upon the fabric. Due to a greater amount of experience, and a greater production on fancy fabrics, the foreign manufacturer has developed ideas which as yet are often submerged in the quantity production methods adopted generally in domestic mills. Take the fabric which we have analyzed for an example. There are certain artificial silk yarns which can be regularly obtained in the market, but there is not the wide variety of sizes which can be found in cotton yarns. Unless the correct size of cotton yarn is used in combination with the artificial silk it will not produce especially attractive results. Often fabrics are made where the various yarns used do not combine in the manner best suited to produce the most attractive results.

Another feature which is often lost sight of is the fact that

A GOOD SELVAGE

on a piece of cloth will make it appear much better and sometimes bring a higher price. It is not always necessary that the selvage be a wide one, but rather that it combines well with the cloth and does not have a ragged or uneven appearance. There are many cloths produced which would appear far better if the yarns in the selvage were reeded differently. The weave also should be adapted to the cloth construction. There are many converters in the domestic market who will have a certain fabric made by the mill and it will appear entirely satisfactory. Afterwards, they will pick out various designs to be used upon this ground cloth and the results will not be as attractive as was expected.

It is absolutely impossible to place a weave upon a cloth and expect it to appear exactly as well as some other weave does, inasmuch as the combination is not the same and the

CLOTH CONSTRUCTION

and weave combination make the results somewhat different. We have seen many instances where purchasers applied new weaves to fabrics formerly handled, and because the results were not at all like those previously obtained, have criticized the mill severely, claiming that the cotton used, the method of making, or cloth construction was changed in order to make a higher profit, while such was not the case. There are very few reliable cotton manufacturers who manipulate their fabrics when sample pieces have been made and supplied to buyers. It will be noted that the weave of the cloth shows the artificial silk to advantage and some other method might not have been nearly so

satisfactory. It will also be seen that

THE WEAVE HAS MUCH TO DO

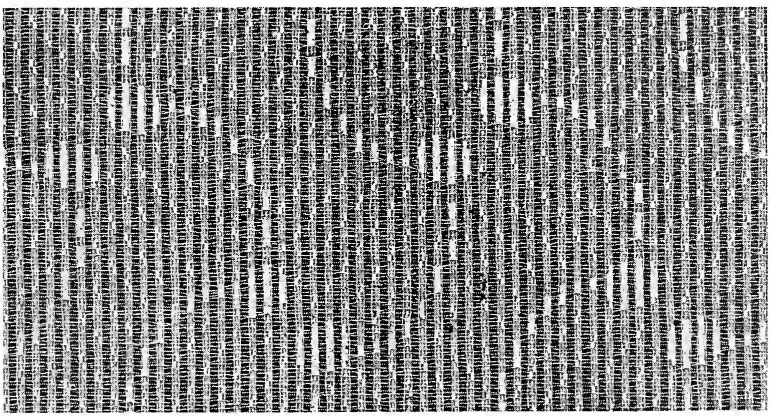
with the cloth effect which has been obtained. In each stripe the three cotton threads weave exactly the same, namely plain weave, while the two threads of silk weave the same in most instances. This allows the various threads to slide together, and the fact that the plain weave in the different stripes changes holds the stripes apart and creates a regular open space. Naturally, this open space is originally created by having an empty dent in the reed, but unless the cloth construction is correct and the weave used one which corresponds, the various threads will spread radically when the cloth is being finished and no open spaces will appear. In a good many openwork fabrics,

A SMALL LENO THREAD

is used alongside of the stripes in order to hold them firmly in place, this being noted more particularly when the stripes are wide. In certain instances, it has been known that manufacturers have used silk for stripes or checks and then eaten out this silk in order to create clear openwork effects. This method, however, is not generally used because of the cost. A very small amount of extra labor, and oftentimes through no extra labor but rather through more ability, the construction and design can be adapted more satisfactorily and much better results produced. Attractiveness is one of the main features to be considered in high-class cotton fabrics and it pays to place emphasis upon the details when the cloth is being planned. Often, the effects of good yarn and good weaving are more than counteracted by a small amount of carelessness in making the design.

HIGH-CLASS YARN A NECESSITY.

We do not believe there are many in the market who realize the great advance which has occurred during the past five years in the quality of the yarn which is used in many of the high-class domestic fabrics. This statement does not mean that there is not still a large field for improvement, but rather that results are much better than formerly. There never has been any great amount of criticism regarding the strength of most domestic yarns, but there has been a great deal of criticism regarding their regularity. Domestic makers use much longer staples and more twist for their yarns than do foreign makers and this accounts for the greater strength even though the yarn is not so good in appearance. One reason why the yarns made in domestic mills are better than they were is



Artificial Silk Novelty Dress Goods.

because makers have been forced into producing better materials or else lose a portion of their business.

Voiles and many other fabrics of a similar character have been in large demand and unless high-class yarns were used results were not especially attractive. A great deal of criticism has been noted in regard to the finish applied to fabrics by finishers of domestic cloths. It may be that such parties are partly responsible for the finish being less desirable than on foreign fabrics, but manufacturers themselves are also partly to blame. It is not possible to obtain as good a finish on a fabric in which uneven yarns are used as it is on one in which the yarns are very regular, and this is one of the reasons why many foreign fabrics take a better finish. Mule spinning and a larger amount of labor have a tendency to produce yarn of a regular character, while quantity production and ring spinning do not tend to make yarn of an especially high quality. As long as quantity rather than quality is the item of importance, just so long will the finish of domestic fabrics be criticized when compared with certain foreign materials.

EASY DESIGN FOR SAMPLE.

There are a great many, having had little experience in the matter, who consider that the making of designs on most jacquard cotton fabrics is a much more difficult process than the making of designs for fancy dobby cloths. This is not true in a majority of instances, and the fabric which we are considering is a good illustration of the simpleness of design work for many materials. Without doubt, an ordinary workman could complete a design such as is noted on the cloth considered in an hour's time or even less. It is not necessary to paint in the entire weave, but rather it is only essential to paint in the portions of the weave where the artificial silk floats on the surface. The plain weave ground can be entirely omitted and introduced by the party who places the weave upon the cards.

It may be well to note that the artificial silk floats for an odd number of picks in every case when the figure is being made. This is necessary because of the plain weave on the other threads in the cloth. Sometimes it is rather

DIFFICULT FOR A BEGINNER

to understand this fact, but by painting in the ground weave around a figure it is easy enough to see how the floats all become odd numbers. The total cost for design, cards and other features for a fabric such as the one considered is not over one-tenth of a cent per yard added to the total cost of making. Of course, a cloth with a greater number of picks per inch, or one upon which a great deal more labor was expended in design making, would cost much larger amount, but for many cloths the cost is of minor importance. The weave and cloth construction have been considered sufficiently in this material, for the best results have been obtained. Many fabrics of a similar character have been sold which do not compare at all with the one considered.

PRODUCTION AND PROFITS.

One feature which has appealed particularly to manufacturers of voiles and similar cloths is that there has been quite a satisfactory amount of profit in their making. This is true at present on all of the good grades, and was previously true even upon most of the lower grades. This satisfactory profit has resulted because the materials contain a comparatively small number of picks per inch, and there was a large yardage produced per loom and a low weaving and expense cost. The material or the yarn which was used in such a fabric form a much larger proportion of the total cost than it did on many fabrics which had been previously made, and for this reason, there was a greater opportunity to obtain a higher profit. A very small amount per yard creates a satisfactory dividend because the total amount is quite large, due to the amount of cloth which can be woven. Naturally, the demand for the material was partly responsible for the large

PROFITS WHICH MANY SECURED.

An item which is seldom considered at all by manufacturers, and by those who do consider it not in an accurate

enough manner, is that which refers to the profits that should be secured on different fabrics. The method most generally adopted in fancy cloth making is to figure profits upon a basis of a certain amount per loom per week. If a fabric produces one hundred yards per week and a manufacturer desires to make $2 per loom per week, the practice is to quote a price which shows about 2 cents per yard profit. This method is approximately correct for fabrics which make it possible for all the machinery in a plant to be operated, but this is seldom noted on most fancy cloths.

Let us illustrate this point a little more clearly. A fancy mill is planned to make a certain kind of cloths, and has a layout with a special number of preparatory machines and a certain number of spindles per loom. Let us say that a mill contains 40 spindles per loom, which would be satisfactory for many fancy cloths. Recently, many mills have made single yarn voiles and also large quantities of crepes and other

SPECIAL YARN MATERIALS.

On many of these cloths almost twice as many spindles per loom are necessary as for ordinary work, and still no change is made in the amount which a manufacturer expects to make on the loom basis. This is an incorrect method, because it will not produce the profits which a manufacturer desires, the loom either earning more or less than the manufacturer has planned. When a greater number of spindles are necessary to produce the yarn for the loom than was planned, the profits are not enough to take care of the spindles and other machinery which are necessary or idle through the cloth being made.

If less spindles per loom are being used the loom is earning more than it should to create the dividends expected. There should also be some provision made for the different kinds of looms employed. It is not a correct policy to expect a jacquard box loom to earn money at the same basic rate as does a dobby or a plain loom, although this method is in more or less general use. Manufacturers have claimed that this policy is necessary, inasmuch as jacquard loom fabrics are sold upon practically the same basis as dobby materials, but the outlay necessary to produce jacquard cloth is somewhat greater and for this reason the amount obtained per yard should be varied accordingly. Much more care is being given to these items than previously, and the time will come when manufacturers will know more accurately just what their various machines are earning.

TARIFF ON ARTIFICIAL SILK.

In regard to fabrics in which artificial silk has been used, there is quite a little discussion being heard and some uncertainty in regard to the rates of duty. The fact that provision was made for artificial silk and artificial silk fabrics in the silk schedule, but that no provision was made in the cotton schedule, is a subject for criticism. When a fabric is woven from artificial silk, and the value of the artificial silk is greater than the other materials used, the fabric is classified in the silk schedule and the rate of duty is 60 per cent. When there is a greater amount of value of cotton yarn in the fabric, the material is classed in the cotton schedule and the rate of duty is 30 per cent. This is a wide variation and will undoubtedly cause quite a little trouble when the fabric is anywhere near the dividing line. The reason the rate of duty is 30 per cent is because no special provision was made for this sort of cloth and it is classified under catch-all paragraph No. 266.

Take the fabric which we have analyzed for an example. A mill which purchases fine yarns in order to make a cloth of this character would cause the fabric to be in the cotton classification, whereas if the artificial silk was handled an excessive number of times, or if only small quantities were purchased, the fabric would, from a manufacturing standpoint, be in chief value of artificial silk. Then, many of these fabrics are piece-dyed rather than yarn-dyed. The losses in finishing are not the same for artificial and for real silk, and the basis which is used for ordinary silk cannot be used at all in making a correct estimate regarding

chief values. A fabric in which the chief value is cotton, and in which a dobby weave has been used, will have no lower rate of duty than if a fancy jacquard weave had been used, inasmuch as the rate of duty for both will be 30 per cent.

This is not correct theoretically, because

ORDINARY COTTON FABRICS

with a dobby weave are assessed according to their yarn size, but a similar fabric with a jacquard weave is 30 per cent. A fabric in which a single thread of artificial silk is used will carry as high a rate of duty as one in which quite a large portion of artificial silk has been used, and this theoretically is not correct and will undoubtedly cause quite a large amount of silk to be used when any kind of a novelty fabric is to be made. Under the present tariff law there seems to be very little equality in the various rates for different kinds of cloth, the discrepancies undoubtedly being greater in number than were noted under the previous tariff law. The method of obtaining the weights of yarn and the weight of the cloth as it is produced by the loom is a comparatively simple process and is as follows:

1,542 ends ÷ (100/2 × 840) = .0367, weight of cotton warp without take-up.
12% take-up in weaving.
.0367 ÷ .88 = .0417, total weight of cotton warp per woven yard.
964 ends ÷ 30,000 yards = .0321, weight of art. silk without take-up.
6% take-up in weaving.
.0321 ÷ .94 = .0342, total weight of art. silk per woven yard.

$$\frac{52 \text{ picks} \times 44\tfrac{1}{2}'' \text{ width in reed} \times 36''}{36''} = 2{,}314$$

yards of filling per yard.
2,314 ÷ (100/2 × 840) = .0551, total weight of filling per woven yard.
.0417 + .0342 + .0551 = .1310, total weight per yard.
1.0000 ÷ .1310 = 7.63 yards per pound (grey).

PATTERN.

100/2 S. I. combed, hard twist	2/24	1	1	1	2/24	=	1,542	Beam 1.
150 Denier artificial silk		1	1			=	964	Beam 2.
		482 ×					2,506	total ends.

100/2 S. I. combed, hard twist; 52 picks.
33 reed; 44½" width in reed, 41" grey width, 39⅛" finished width.
64 × 52 finished count, over all.

YARNS.

	Cotton.	Labor, waste, twisting, etc.		
100/2 S. I. combed warp, 1⅝" staple, 20 hank dou. rov.,	28½c.	53¾c.	=	82¼c.
100/2 S. I. combed filling, 1⅝" staple, 20 hank dou. rov.,	28½c.	47¼c.	=	75¾c.
150 Denier art. silk, 30,000 yards per lb.			=	$2.15

1,542 ends 100/2 S. I. combed warp + 12% take-up	= .0417	@	82¼c.	=	$ .0343
964 ends 150 Denier art. silk + 6% take-up	= .0342	@	$2.15	=	.0736
52 picks 100/2 S. I. combed filling	= .0551	@	75¾c.	=	.0418
Weaving					.0316
Expenses					.0164
					$ .1977
Selling (grey)					.0040
Mill cost (grey)					$ .2017
Mill price (about)					$ .2200
Cost of dyeing and finishing					.0350
Converter's expenses					.0200
Converter's cost					$ .2750
Selling price (about)					.3350
Retail price					.5000

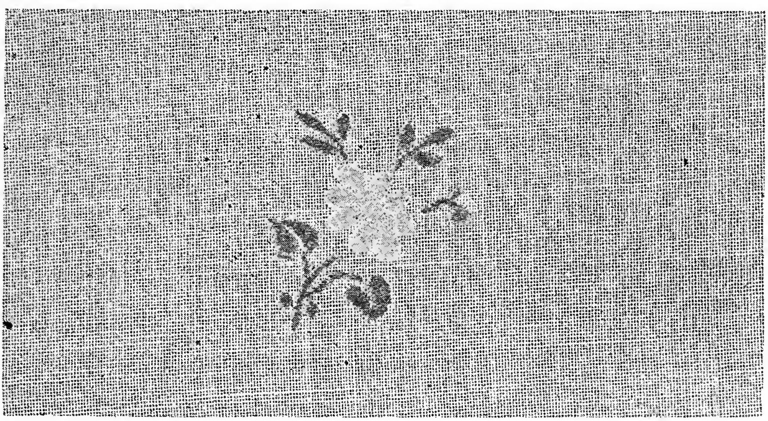
Foregoing prices estimated on domestic basis of direct selling
Actual retail price $1 per yard, imported.
Rate of duty 30%.
Yards per pound 7.63 (grey).

SWIVEL DOTTED SWISS

A variety of cotton fabric which is gradually becoming of greater importance in textile distribution is that class of materials which are known as swivel fabrics. These are not produced in the domestic market to any extent; in fact, it is probable that no more than one or two mills are capable of making such fabrics at all. There is a good reason why such a condition exists, mainly being that jacquard work represents the highest type of ordinary woven fabric which can be made, and swivel work is intricate jacquard weaving. Because of the newness of the domestic fancy goods industry, there really has been very little time for the development of fancy jacquard weaves, inasmuch as simple jacquard fabrics are not produced in as large amounts as might be possible. Fabrics made by the swivel mechanism are oftentimes composed entirely of silk, but there are certain styles of cloth which are

MADE ENTIRELY FROM COTTON, and which have a wide distribution. Possibly, fabrics similar to that analyzed illustrate the largest selling lines of swivel production, but there is a wide variety of figures of a much more intricate character, which are regularly produced, though their construction varies according to the style of figure in demand.

Because there are very few looms capable of producing similar fabrics in the domestic market, most of such cloth is made in foreign mills, though it is very probable that there will be an increase in the domestic production in the near future. As a general thing, swivel fabrics made from cotton are used for waists, dresses and other similar purposes where an expensive and rather light fabric is desirable. Due to the method of producing, the labor and expense cost of making these fabrics is much higher than it is in practically all lines of domestic made fabrics.



Double Shuttle Swivel Fabric.

It is probable that in most cotton swivel fabrics the material used forms less than 25 per cent of the total cost with labor and other items constituting the remaining cost. The main characteristic of most swivel fabrics is a very light ground decorated with relatively heavy spots or figures. In a good many instances, the fabrics are used as overdresses, with the figures showing contrast with the ground cloth, and also with the underdress.

In a general way there are three

methods which are largely used in decorating a light fabric ground with an extra figure. First, is the method ordinarily known as box loom work, in which an extra filling of a heavy character is inserted for the whole width of the cloth, and when the weaving operation is completed a portion of the extra heavy filling is sheared away, leaving only the light ground cloth with heavy interwoven figures. These box loom figures are made on a wide variety of fabrics, but can usually be distinguished very easily. A second method of production is that ordinarily known as lappet work. In this method an extra motion is attached to the loom lay. In this extra motion there are a certain number of needles which project downward, the number of needles depending upon the pattern being woven, and these needles containing ends of yarn are moved backward and forward as the pattern is made. Sometimes the patterns are trailing ones, while in other instances they are various kinds of spots.

In the first case shearing is not necessary, while in the second case, a succeeding process is necessary to cut away the loose thread which is noted because a single thread continues to form succeeding spots and passes from one to the other. This kind of woven figure can be easily distinguished from a box loom woven figure, because each spot is made from a single thread, whereas this does not occur when a box loom is used. It is, however, not so easy to distinguish certain kinds of lappet work from certain kinds of swivel work, though, in the majority of instances there is no question regarding the method of production. Wherever a certain type of figure can be produced by either lappet or swivel motion, the difference in method used can be noted through the irregularity in lappet motion operation as seen in the woven cloth and also by the fact that the ends of the sheared lappet spot are practically always on the face of the material, whereas, on swivel work they are on the back of the cloth. Swivel work is not only the most expensive method of making decorated cloths, such as are described, but is also best, though the most complicated method.

COST OF PRODUCTION.

The various methods in relation to cost of production are, first, lappet; second, box loom work, and third, swivel work. The various swivel figures as woven are made as exact as any jacquard woven figures; in fact, the jacquard motion is responsible for the interweaving of a swivel yarn and the motion can be depended upon to produce exactly the same effect in every repeat of the pattern. To a certain extent swivel work appears somewhat similar to lappet. There is ordinarily only one thread used in making each figure, that is, if only one bank of swivel shuttles be used, and the swivel yarn does not pass across the entire warp, but rather interweaves where the figure is being formed. In swivel work there is a small spool of yarn used for each swivel shuttle, whereas in ordinary lappet work, all of the various threads forming similar figures are placed upon a large spool which is placed upon the loom frame. There are a good many consumers who do not distinguish between swivel and embroidered cloths. In a swivel woven fabric the ends which decorate the cloth are always in a horizontal position, because the swivel shuttles operate in a similar manner to ordinary loom shuttles, while in an embroidered fabric the yarn which decorates the fabric is likely to be at any angle to the warp and filling, according to the pattern which is being made.

METHOD OF OPERATION.

To a good many, especially in the domestic market, the method by which swivel patterns are made is not especially clear, and while it is not possible to give any detailed explanation in a short description, nevertheless it may be well to state a few of the fundamental features. In the first place, there are three general types of swivel mechanisms used. Possibly, the one which is used most extensively is that one wherein certain small shuttles of a horizontal nature are introduced into the fabric where the swivel figure is to be made. These

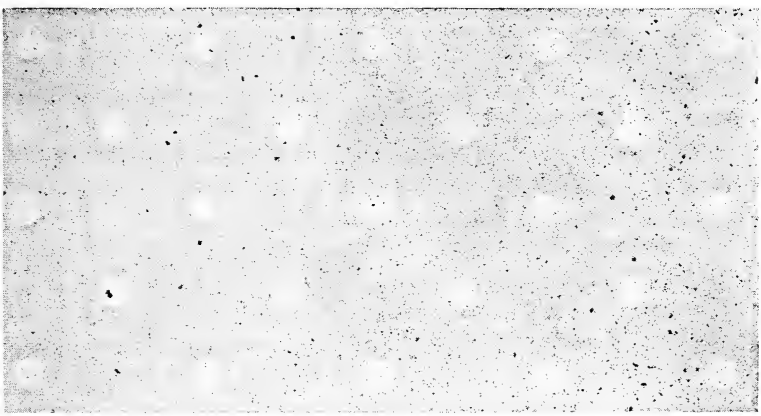
small shuttles contain very small spools of yarn, and there may be more than one bank of the shuttles according to the fabric to be produced, or the loom mechanism. These small shuttles have to correspond to the tie-up of the jacquard machines, and vice versa. If a 600-jacquard machine is used with a tie-up of 100 hooks per inch it will give a repeat in the reed of six inches.

If two swivel shuttles be used, the pitch of the swivel shuttle will be three inches, whereas, if four shuttles be used, the pitch will be one and one-half inches, etc. There is a certain limit below which it is not satisfactory to go into the matter of shuttles by this method. To make the swivel pattern the various jacquard hooks are raised as desired, and the mechanism holding the swivel shuttles is lowered, the small shuttles passing underneath a portion of the warp threads. This is accomplished through a rack and gears upon the loom lay, the small shuttles passing from one shuttle holder to another. It must be remembered that a certain portion of the warp must remain down to allow space for the small shuttles to be inserted. When the swivel figure is being made the ordinary picking motion does not operate. From this foregoing description it might be supposed that allover patterns could not be produced, or if they were made, only in a striped form, but this does not occur because the mechanism which holds the shuttles can be moved to the side to correspond to the pattern which is being made, and to allow space for the swivel shuttles to be inserted.

A second kind of

SWIVEL MECHANISM

might be considered somewhat similar to the one already described, but it has a number of different features. In this method the swivel shuttles are smaller and there usually are more shuttles in the cloth width. In a good many cases these small shuttles will traverse about one-half an inch in the cloth width, or will make a woven pattern from each thread about half an inch wide, though the combination and manipulation of the various shuttles will make large allover patterns. These small shuttles are lowered in the cloth shed, and instead of being transferred from one shuttle holder to another by rack and gears they are transferred by small levers which are operated by the loom mechanism. In this case there may be certain shuttles idle a portion of the time where no figure is being made, but this causes no difficulty. The swivel mechanism is not moved in a horizon-



Swivel Dotted Swiss.

tal position in this method, but rather remains stationary, and the numerous swivel shuttles will produce the pattern wherever the warp threads are raised.

A third method which appears different than either of those described is one wherein a small shuttle travels underneath the warp threads in a circular holder. In this method it is only possible to use one color of swivel thread at any time, inasmuch as there can be but one bank of swivel shuttles, but there is a certain advantage over the first method described, inasmuch as it allows the swivel shuttle to pass under a greater number or portion of warp threads. This is explained by the fact that less space is necessary than in the first method for the swivel shuttles to be inserted. As the swivel motion is a more expensive one it may be wondered wherein any advantage is secured. In the first place, various clear-edged figures can be made similar to those produced on the ordinary jacquards and be made of heavy extra yarn in order to show striking contrasts. The method of using the swivel motion saves a great deal of yarn, and while this is of minor importance when compared to the effects produced, nevertheless it is essential.

The swivel motion is also of advantage in decorating certain jacquard figures upon various fabrics, that is, it may be desirable to have a flower upon a certain woven pattern made of colored yarn or of a heavier character than the ground fabric, and a swivel motion allows this to be done. In cotton fabrics most of the swivel decoration is done in one color, namely that of the ground cloth, but there are an increasing number of fabrics which importers are showing to-day, where figures are introduced of one or more colors and contrasting decidedly with that of the ground cloth. On page 179 we illustrate one of the small figures often used with two colors. This is especially true on certain lines of crepe cloths now being offered. There are other advantages to be obtained, such as a spot or figure which will stand up better than by any other method, and bound in more firmly.

There are certain features in connection with the fabric analyzed which are worth mentioning. In the first place, it is about as simple a figure as is ever made on a swivel mechanism, being one of simple detached spots. It will be noted that the spots are quite large and prominent and seem the same, both on the face and back of the fabric. This is made possible through the weaving process. There are four picks from the swivel mechanism to one pick of ground cloth, when the spot is being woven, in other words, the swivel shuttle passes around certain warp threads twice before a ground pick is inserted. This can be accomplished very easily and is often done for fabrics such as that described. In many other instances the swivel shuttle does not pass entirely across the back, but is brought up and acts as a stuffer to the portion of the thread which is seen on the face. Were the spots being made continuously, or were the swivel pattern always being made, there would be four times as many picks of swivel yarn as there would be for the ground cloth, but inasmuch as the swivel mechanism is not operating a portion of the time, this ratio does not occur for the whole fabric. Instead of there being 240 picks of swivel and 60 picks of ground, there are practically 71 picks of swivel and 60 picks of ground, or a total of 131 picks per inch in the cloth as it comes from the loom.

To make the second row of spots, the mechanism is moved over, the spots inserted and then it is returned to its original position, where the operation is repeated. One of the

INTERESTING FEATURES

in regard to the swivel work is that the cloth is woven face down. This is necessary because the swivel shuttles are placed above the warp threads, and because the loose threads, which go from one figure to another as spot patterns are being made, are on the top of the cloth when it is being woven. A cloth such as that described has to have a shearing process in which the thread which goes from one figure to the other is cut off. It is always a very good policy to have as much ground cloth as

possible next to the selvages in order to make the weaving operation as easy as possible.

Because the fabrics are of a light character it is customary to use a plain weave ground for fabrics such as are described. A woven ground figure never appears at all prominent on such a light material, though on other constructions intricate jacquard weaves are used, together with the swivel figures. One of the features which causes quite a little difficulty in the production of a fabric such as that analyzed is that the small swivel shuttles do not contain any great amount of yarn, and because of the heavy character of the spots the material is used up rapidly, causing many changes of shuttle spools and a corresponding loss in production.

SIMILAR CLOTH GROUNDS.

Inasmuch as these fabrics are largely a foreign product it may be well to comment regarding the quality. Foreign fabrics are usually made by somewhat different methods than those produced in the domestic market, and it can be stated positively that in quite a number of instances the method of production does not result in what would be considered high quality fabrics in the domestic markets. This is especially true on some of the medium-weight fabrics such as the ground cloth of the fabric analyzed. The foreign method of yarn making, wherein a relatively short staple of cotton is used and wherein the yarn is spun upon the mule, does not produce yarn of great strength. It does make a soft, round yarn which is very desirable for certain fabrics, but is not desirable for a fabric such as that analyzed. The yarn in this fabric is regular, but it is not strong. We do not believe there is a single mill in the domestic market which, if asked to produce a ground cloth such as that noted in the fabric described, would not produce a cloth which would break twice as high as the foreign material and wear twice as long.

This may seem a

RADICAL STATEMENT,

but, nevertheless, it is true, and what is more, the same conditions are noted on a great many more fabrics than either foreign manufacturers or domestic distributors are willing to admit. In discussing imported fabrics buyers never give credit to domestic manufacturers for any superiority whatever, when there are a good many instances where domestic fabrics are much superior. Soft twist and short staple are of advantage for certain fabrics, but long staple, a higher standard of twist and strength are desirable for other fabrics, of which the one presented is an illustration. We do not believe there is a single mill in the domestic market which is weaving as weak yarn as that in the fabric analyzed, and if any attempts are made to import yarn of a similar character and weave it, there will be so many difficulties that domestic manufacturers will give up the idea in disgust.

This does not mean that foreign manufacturers cannot and do not make high-class yarns, for this is not true, but when comparisons are being made it would be just as well if other important features were considered along with the price. There would have been fewer fabrics imported in the past if buyers had treated domestic fabrics fairly, but they have not only built up many wrong impressions regarding the quality of foreign fabrics, but also as to their values. Where such materials are distributed to a high-class trade it makes little difference, but inasmuch as ordinary consumers are buying increasing amounts of high-priced fabrics there is sure to be a much different idea regarding the wearing quality and actual value.

The fabric analyzed was imported and sold at retail at 46 cents per yard. We have given an approximate cost of production upon a domestic basis. Of course, this cost might vary somewhat in a domestic plant, but it is a high cost if anything. Other styles of patterns return a somewhat higher price than that noted and this shows that there is an opportunity for domestic manufacturers to introduce the making of such cloths. We have estimated the maker's selling price at 25 cents per yard, which would allow quite a high rate of profit to a domes-

tic producer. Undoubtedly, a manufacturer could produce this cloth to sell as low or lower than that of the foreign manufacturer, and what is more, it unquestionably would be of much higher quality.

The production of swivel patterns is a much more staple business than many would consider to be the case and it would be possible for a moderate-sized plant to be operated continually on staple patterns such as that illustrated. The introduction of silk into cotton fabrics and woven in cotton mills offers unlimited opportunities in various kinds of swivel work. There is a large opportunity, because these combination fabrics have been produced much more extensively in the domestic market than they have in foreign mills, in fact, there have been quite a number of such cloths exported during the past two years. The prices for such cloth are naturally high and will remain so as long as present methods of production continue, but there is a growing demand for fabrics which contain style, and the swivel mechanism makes it possible to decorate a fabric more extensively than the ordinary jacquard mechanism.

There are certain features in regard to obtaining the weight of the cloth which must be considered carefully, or accurate results will not be obtained. Of greatest importance is the amount of yarn necessary to weave the various spots. This is quite large, inasmuch as the swivel threads pass around the various warp ends twice before a pick of filling is inserted. The take-up in weaving is quite a little greater than for similar spots made on a lappet motion, for it takes about ten inches of yarn to weave one inch of fabric. Instead of a single thread being used for this swivel figure, there are three ends used in each shuttle, but they are not twisted together. This allows a better spot to be made and does not cause streaks in the fabric when the swivel filling is being inserted. The method of obtaining the weights is as follows:

2,372 ends ÷ (80/1 × 840) = .0353, weight of warp without take-up.
4% take-up in weaving.
.0353 ÷ .96 = .0368, total weight of warp per woven yard.
36 × 3 = 108 swivel ends.
90% take-up in weaving.
108 ÷ .10 = 1,080 yards of swivel yarn per yard of cloth.
1,080 ÷ (80/1 × 840) = .0161, total weight of swivel warp per woven yard.

$$\frac{60 \text{ picks} \times 33\tfrac{1}{2}'' \text{ reed width} \times 36''}{36''} = 2.010$$

yards of filling per yard of cloth.
2,010 ÷ (95/1 × 840) = .0251, weight of filling yarn.
.0368 + .0161 + .0251 = .0780, total weight per yard.
1.0000 ÷ .0780 = 12.82 yards per pound (grey).

PATTERN.

80/1 Am. combed warp $\frac{2}{12}$ 2,324 $\frac{2}{12}$ = 2,372, total ends.
80/1 Am. combed for swivel. 3 ends per shuttle not twisted.
95/1 Am. combed filling. 60 picks per inch ground.
Average picks per inch over all 131.
35 reed; 33½" width in reed, 31⅝" finished width.
74 × 60 ground count; 74 × 131 over all count.

YARNS.

	Cotton.	Labor, waste, etc.		
80/1 Am. combed; 1 7-16" sta.; 16 hank dou. rov.,	23½c.	28¼c.	=	51¾c.
95/1 Am. combed; 1 7-16" sta.; 22 hank dou. rov.,	23½c.	27¾c.	=	51¼c.

COST.

2,372 ends 80/1 Am. combed warp..........+ 4% take-up = .0368 @ 51¾c. =	$ .0191
108 ends 80/1 Am. combed warp..........+ 90% take-up = .0161 @ 51¾c. =	.0084
60 picks 95/1 Am. combed filling........................= .0251 @ 51¼c. =	.0129
Weaving	.0564
Expenses	.0735
	$ .1703
Shearing	.0030
Bleaching and finishing............................	.0100
	$ .1833
Selling	.0065
	$ .1898

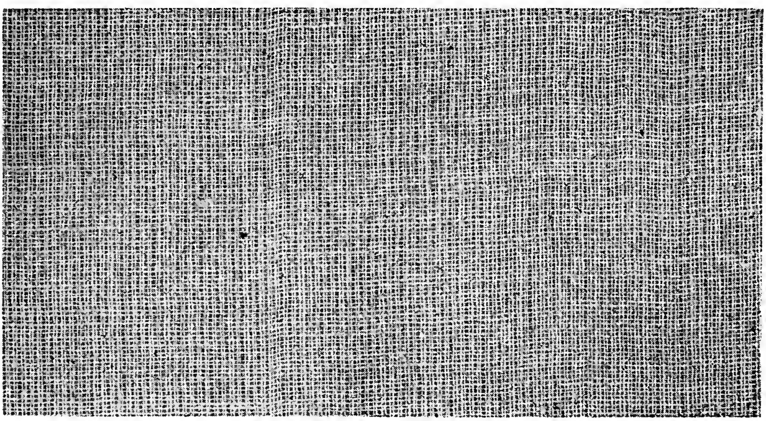
Selling price (approximate) 25c.
Domestic retail price 46c. per **yard**
Yards per pound (grey) 12.82.
36 swivel **shuttles necessary.**

TOBACCO CLOTHS

One cotton fabric which has a very extensive sale and is considered a staple line is tobacco cloth. In a general way, this material is not used regularly for dresses, but other uses create a large demand and keep a good many coarse mills with many looms continually producing certain constructions. The cloth is a light one, and is particularly noticeable because of its cheapness. To a certain extent, it is known as cheesecloth to-day, but because of the use for other purposes, it has come to be known as tobacco cloth to manufacturers, and the number of constructions produced varies quite extensively from that noted a few years ago. this is not the case. In warm climates it is not so necessary for ordinary houses to be plastered, and a light cloth is used instead, which makes it possible for this cloth to be used as wall paper in a satisfactory manner. A much larger portion of the product is used for the above purpose than many believe. Another use which is rapidly increasing is for

ANTISEPTIC GAUZE,

of which tobacco cloth forms the foundation. Much more care is being used in all kinds of surgery and similar purposes than ever before, and has made a large production of these cloths possible. During recent years there has been quite a large distribution of open fabrics for printed draperies and similar purposes. All



Tobacco Cloth.

The name cheesecloth undoubtedly developed because the material was used for covering cheeses, and the change in name has occurred on account of its greater use for other purposes.

Probably the change in name occurred because a large quantity of such cloth is used in the tobacco fields, where it serves various purposes and is responsible for an improved product. It must not be thought, however, that the use in tobacco fields constitutes the entire distribution, for kinds of drapery fabrics have been selling well for a number of years, and to make it possible to get out fabrics at a low price a low constructed material has been used quite successfully. Certain of these draperies are sold in quite large volume in the 5 and 10 cent stores, and it would not be surprising if other materials were sold in a like manner in the future.

Certain kinds of fabrics which might be ordinarily known as tobacco cloths form the foundation for many of the cheap printed drapery fabrics recently

offered. There are numerous other purposes for which more or less of such material is used, and altogether the sale is quite an important one. At certain seasons of the year there is a large demand for various kinds of cheap bunting. In many of these materials tobacco cloths form the foundation for the printed results. What consumers want is a large yardage for a small outlay, and tobacco cloth is about as desirable, if not more so, than any other cotton fabric.

METHOD OF PRODUCTION.

Tobacco cloth represents what can be done in cloth production at a very low cost. In most instances where cloth is being made certain ideas as to style, effect, or uses determine largely what the cost of making or the selling price is likely to be. It is seldom that low quality cloth is desirable, but with tobacco cloth, the main features are large quantity and low selling price. Because of this fact the various machines in the mill are operated to their greatest capacity within reason, and the yarns and fabrics are not based upon as high a standard as for most other fabrics. In making the yarn as short a cotton staple is used as is possible, and still obtain a good production. There is a certain point beyond which a manufacturer cannot go and still get the best results, and this is why yarns of even lower quality or shorter cotton are not sometimes used. It does not pay to make yarns of so low quality that the weaving expense increases radically, because the cost of material in such cloth is a relatively small one.

In a good many instances, the yarns are made from single roving, though the product has to be somewhat better when automatic weaving machinery is being used. The production in yards per loom is very large, mainly because the cloth construction is very low. Inasmuch as plain weave will return the firmest fabric for any given construction, it can be said that plain weave is invariably used upon tobacco cloths. Most of such fabric constructions slip quite badly, and this makes them impossible of use for dress fabrics, even though

ATTRACTIVE PATTERNS

might be printed upon them. Possibly in the majority of tobacco cloth constructions, the ordinary yarns which are used in print cloth constructions are noted, that is, approximately 28-1 to 30-1 warp, and from 36-1 to 40-1 filling. For the coarser constructions or lower count fabrics, coarser yarn sizes are used, as can be observed from the weights of the various fabrics. Some of the constructions which are sold regularly are as follows, though they do not represent all of the fabrics which are sold. In a general way they represent about the highest and lowest constructions which are regularly sold. For the lower count fabrics the cloth weight will vary with different makers.

		Yards per pound	cents
48/44	36 in.	7.75	3⅝
48/40	36 in.	8.10	3½
44/40	36 in.	8.50	3⅜
40/40	36 in.	9.20	3⅛
44/36	36 in.	9.20	3
40/36	36 in.	9.65	2 15-16
40/32	36 in.	10.20	2⅞
36/32	36 in.	10.50	2¾
36/32	36 in.	11.20	2 11-16
32/28	36 in.	12.00	2 7-16
32/28	36 in.	13.00	2⅜
32/24	36 in.	13.50	2 5-16
28/24	36 in.		2 1-16
26/22	36 in.		1 15-16
24/20	36 in.		1 13-16
22/18	36 in.		1 11-16
20/16	36 in.		1½
20/14	36 in.		1 7-16
20/12	36 in.		1⅜

These fabrics are all in the grey state, and the selling prices represent the relative difference between the various constructions with cotton selling from 13 to 13½ cents per pound. It will be noted that the constructions are sometimes similar, but that the weights of the cloths will differ, due to the use of different sizes of yarn. A good many mills figure their cloth prices upon a poundage basis, and relatively, the selling prices per yard can be arrived at upon this basis.

As previously stated, the weaving of the cloth in a successful manner depends a good deal upon the yarn or-

ganization of the plant. If very poor yarns are made it will be absolutely impossible to run the looms at the highest rate of speed at which they are capable of being operated, whereas if a longer cotton and better yarn be made, it will be possible to run the looms at a higher speed or to use automatic weaving machinery. Undoubtedly, automatic looms are of distinct advantage where plain cloth is to be made, and where quantity production is of so great importance. A fact which a good many manufacturers overlook is that there is a certain balance which is best for each plant. In a fabric such as is being described it would be a foolish policy to use a long staple of cotton to make especially good yarn, and to weave the cloth on an ordinary loom at a low or relatively low speed. Of course, such a method of production would result in a better looking fabric, but it is absolutely certain that a cloth maker would not obtain a price which would return him a satisfactory dividend. There are very few fabrics of this character made in which cotton over 1 1-16 inches in length is used, and it is probable that a large majority of these cloths contain cotton which is one inch or less in length, according to the best standards of cotton length. There have been some manufacturers in the past who

ADVOCATED AUTOMATIC LOOMS

for light cloths and a very high speed, or one which approached that obtainable on ordinary looms. Through experience this has been found to be a mistaken policy, and lower loom speeds are now generally adopted, together with cotton which seems best at the lower or reasonable speeds.

The fabric which we have analyzed is probably one of the best tobacco constructions made, inasmuch as it counts 48 x 44, and is about as heavy as any fabric regularly sold for such purposes. The size of reed which is used in making any construction will vary somewhat, depending upon the twist in the yarn, the length of cotton which has been used and whether or not the cloth is woven upon an automatic loom. If the cloth shrinks a good deal in the weaving operation a coarser reed will be necessary, while if there is very little shrinkage from reed to cloth width, then a somewhat finer reed will be necessary. This difference in reed size or dents per inch will not amount to very much when the cloth count is low, but where there are more threads per inch, the shrinkage in weaving width becomes of greater importance. We have seen staple fabrics changed from ordinary to automatic looms, and in a large number of instances new reeds had to be obtained, because the shrinkage was not identical.

PRICES AND PROFITS.

A few facts regarding the prices and profits secured upon tobacco cloths may be of interest. In the first place, to one not conversant with manufacturing, the selling price of these cloths would seem so low that it would not return any profit whatever to the maker. The reason why the price is so low is because only a small amount of material per yard is used and because the production is so great that the cost of putting the yarns together is relatively a small amount per yard. Take the cloth which we have analyzed as an illustration. The mill cost is three and four-tenths cents per yard. The mill's selling price to-day is three and five-eighths cents per yard. This allows a profit per yard of somewhat less than one-quarter of a cent, or .225 cents per yard. On most fancy fabrics this small profit would not return a satisfactory dividend, and few manufacturers would feel like operating at such a small profit. Due to the large number of yards produced per loom, this small profit per yard appears much more satisfactory when considered upon a production basis, and while the prices are not especially satisfactory to-day, the small amount named will return per year a profit of about $36 per loom.

Considering the cost of building a plant to produce cloth of this character the rate of profit upon the investment would be about 5¾ per cent. Any concern which has considered depreciation in the past, and which has a low capitalization per

spindle or per loom, would necessarily show somewhat larger earnings. All of the estimates of cost made are upon an ordinary loom basis and wherever automatic machinery is used the cost would be lower and the rate of profit somewhat higher. The total product of mills making tobacco cloth is large in yardage, but relatively small in value when compared with practically all other woven materials.

Inasmuch as tobacco cloth is used for different purposes, there is quite a variation in the method of finishing, though, naturally, results do not vary as widely as they do on some of the more expensive materials. A large amount of this cloth is used in the grey state, because low price is the item of great importance, and because the cloth in the grey state answers the purpose just as well, and probably better, than if it were finished. When it is used for covering cheeses it naturally is bleached and whenever the cloth is sold in solid colors it is piece-dyed. When the material is used for bunting, it is sometimes piece-dyed, and in other instances printed, depending upon the results which are desired. When the material is to be used for antiseptic gauze it naturally has to be treated more carefully and, in addition to the bleaching process, is subjected to further manipulation, which causes it to be of an antiseptic character. When the fabric is used for draperies it is usually bleached, and then printed with the pattern and colors which happen to be in demand at that particular season. As a general thing, the cloth sells for less than 10 cents per yard in the finished state, some of it being much lower than the price named. There are

OTHER INSTANCES

where certain of the low constructed tobacco cloths are used for particular purposes when the material is filled quite extensively, the substances used varying quite a little. A large percentage of these light-weight tobacco cloths are sold in the grey state at 36 inches wide, and they are also finished at approximately this same width, inasmuch as they are not usually allowed to shrink very much when they are being finished.

The same conditions are noted in finishing as for other kinds of cotton cloth, and the method by which they are finished will affect the width of the cloth when it is ready for sale. Naturally, the finisher tries to have the fabric look as well as possible, and works the cloth in order to make the various threads and picks slip into their proper places, but due to the low construction of most of these fabrics, the threads do not remain in their positions after the material has been used. This is not especially objectionable for most purposes where the cloth is largely sold. There is nothing of particular interest in the method by which the yarn weights are obtained, though one notable item is observed in the amount of size which remains in the warp yarn after the weaving operation is completed. Some manufacturers make their warp yarn slightly finer than they figure in order to take care of the size in the yarn, while others add a certain percentage of weight to the yarn to bring the figured cloth weight what it actually is. Unless some allowance is made for this feature the actual weight of the cloth will invariably be heavier than the figured weight will indicate. The weights are obtained as follows:

1,748 ends ÷ (30/1 × 840) = .0694, weight of warp yarn without take-up.
5% take-up in weaving.
.0694 ÷ .95 = .0731, total weight of warp yarn per woven yard.

$$\frac{44 \text{ picks} \times 38\tfrac{1}{2}'' \text{ reed width} \times 36''}{36''} = 1{,}694$$

yards of filling per yard of cloth.
1.694 ÷ (36/1 × 840) = .0560, total weight of filling per woven yard.
.0731 + .560 = .1291, total weight per yard.
1.0000 ÷ .1291 = 7.75 yards per pound (grey).

PATTERN.

30/1 Am. carded warp $\frac{2}{8}$ 1,716 $\frac{2}{8}$ = 1,748, total ends.
36/1 Am. carded filling. 44 picks per inch.
22½ reed; 38½" reed width, 36" wide grey.
48 X 44 grey count.

YARNS.

	Cotton.	Labor, waste, etc.		
30/1 Am. carded; 1" staple; 3.50 hank single rov.,	13¾c.	6½c.	=	20¼c.
36/1 Am. carded; 1" staple; 4.75 hank single rov.,	13¾c.	6¼c.	=	20c.

COST.

1,748 ends 30/1 Am. carded warp + 5% take-up = .0731 @ 20¼c.	=	$ .0148
44 picks 36/1 Am. carded filling = .0560 @ 20c.	=	.0112
Weaving		.0035
Expenses		.0041
		$ .0336
Selling (grey)		.0004
Mill cost (net)		$ .0340
Mill selling price to-day		$ .03625
Mill profit per yard		.00225

Mill profit per year, per loom, about $36.
Rate of profit upon investment, about 5¾%.
Yards per pound, 7.75 (grey).
Plain weave.

JACQUARD FILLING REVERSIBLE

Without doubt, one of the best selling and most important lines of all cotton cloth which might be considered in a staple class is that which is ordinarily known as cotton blanket cloth or sometimes from a mill standpoint as a filling reversible. The manufacturers who produce these materials have been especially well sold for a number of years past, and there is every prospect that the demand will continually increase. During recent years, quite a large number of these fabrics have been made on jacquard looms and their uses are quite varied, though naturally the largest distribution is noted for blankets for various purposes. They are also

USED FOR BATH ROBES

in place of the more expensive wool materials and many other purposes where a heavy, soft fabric is desirable. The colors which are used do not change radically from year to year, this being of advantage in producing the cloth. In some instances, various colors of cotton fibre are used in order to make a different shade of yarn, and the result seems to be entirely satisfactory for the fabric considered. The pattern analyzed has been produced in this manner, inasmuch as black and white cotton have been mixed to give a sort of grey effect to one surface of the woven material. The present season these cotton blankets were sold up very early, and if reports from distributors be believed, there is a much larger demand than there is supply. Quite a number of these fabrics are

MADE WITH BORDERS

at either end, this giving a finished appearance, although it does increase the number of cards necessary to produce the design. The ends of the blanket are cut and then bound with a buttonhole stitch to keep the end of the cloth from unraveling. Many blankets for children's beds are retailed at 75 cents each, this price showing a somewhat larger profit per yard than when yarded goods are distributed.

The patterns which are used on fancy cloths of the character described are not especially intricate, because the cloth is not of a very high count, and only general effects are possible. Any weave where the threads change a great deal would not show prominently enough to be of great value, because such changes would not appear when the cloth was napped. The figures are mostly large ones, when compared with those applied to most

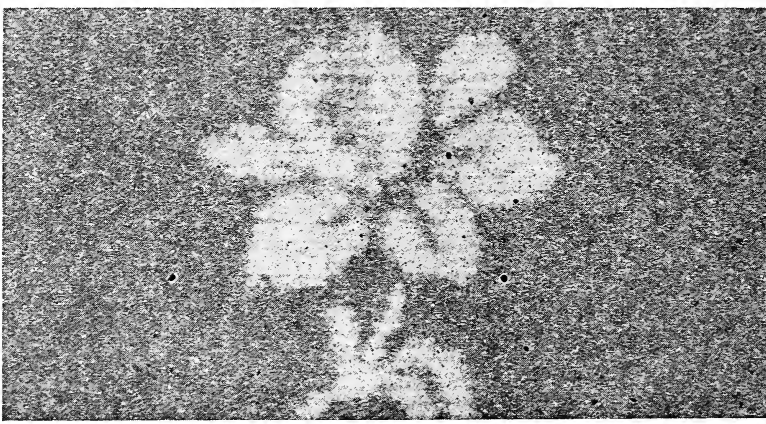
of the ordinary cloths, the effects being somewhat similar to the large brocaded ones ordinarily made entirely from silk, though, because of the cloth construction, the result is entirely different and not nearly so fine when the figure details are considered. Many of the children's bed blankets in recent years have been ornamented

WITH FIGURES OF ANIMALS,

such as kittens, ducks, dogs and others of a similar nature which are well known to children. These styles have had a very large sale, and undoubtedly will be continually in demand. Many consider that the fabric is a double one, because one side of the cloth appears to be the reverse of the other, so far as the color and pattern are in ordinary fabrics, is that the weave, although it gives the same results, changes somewhat

ON EVERY FOUR PICKS,

and the threads which operate on the first four picks do not work on the second four picks, that is, relatively speaking. The weave which we illustrate shows this quite clearly. Notice that threads one and two in the first two picks operate in a twill manner, while threads three and four do not operate on the first two picks. On picks five and six, threads one and two do not operate, while threads three and four operate somewhat similar to what threads one and two do on the first two picks. It may be wondered why this method is adopted. For one thing, it binds the cloth



Jacquard Filling Reversible Fabric.

concerned. This is not the case, inasmuch as only one warp is used with two fillings. The method in which the weave is constructed is shown by the illustration, of which we are giving a number of repeats. It will be noted that two picks weave on the face and the succeeding two picks weave on the back of the cloth, and where the figure is formed the ordinary position of the various yarns is reversed. One point of importance which is worth mentioning, and which often is not considered to a great enough extent firmly together and makes it much stronger when it has been napped. For another thing, it causes the same number of changes in weave upon each warp thread, a fact which is of great importance in good weaving and which makes but a single warp necessary. With any radically different weave it would be necessary to use more than a single warp beam, and when this occurs, costs of making increase along with weaving difficulties. Because there are so few picks per inch, namely only twenty-seven,

on the face and also on the back of the cloth, it is possible to distinguish the picks of filling in the material. This can be noted only on the figure and not on the ground cloth, at least it cannot be noted on the side of the fabric where the darkest color is used, and it is caused by the reversal of the two fillings to form the figure.

THIS REVERSAL OF FILLINGS

separates the yarn and makes a certain amount of streakiness which cannot be entirely avoided. Not all fabrics of the character described are produced on a jacquard loom, for many are made on dobby looms. The ground weave, as will be seen from the weave illustrations, necessitates the use of only four harnesses, with two extra for selvages, which makes it possible to use quite a good many other harnesses in the production of dobby figures, although, of course, the variety of patterns produced in this manner is limited.

INTERESTING DETAILS.

There are a large majority of manufacturers, and probably nearly every distributor and consumer, who do not realize some of the methods which manufacturers of certain cloths adopt in order to produce materials at a lower cost. Certain manufacturers of staple lines use cotton which is bleached and dyed before it is handled, and in this way obtain quite a radical reduction in the cost of the yarn. Other makers use yarns which are dyed fast in stripes and checks, and grey yarn in the body of the cloth and then piece-bleach this material, thus obtaining a lower cost. There are undoubtedly shirting fabrics selling in the market which are sold by one class of mills at least 5 cents per yard lower than can be obtained by another class of mills. Take this cloth which we are considering. There are certain of such fabrics manufactured in which the warp is made of unbleached or only half-bleached cotton, while the filling is made of ordinary bleached and dyed yarns. The reason this can be done is because the filling is radically heavier than the warp, and when the cloth is napped, the warp yarn is entirely covered. This results in a

LOWER COST OF PRODUCTION,

and would be overlooked by a good many in planning economy. These napped fabrics lose a large amount of weight, relatively, when they are finished. This is because the filling forms such a large proportion of the cloth weight and the napping process affects the heavy filling yarn. Ordinary napped fabrics may sometimes be napped just as hard or harder than certain of the blanket cloths considered, but there is not so great a difference in the total warp and filling weight, and therefore a smaller total weight lost. A feature of importance is that both sides of the fabric are napped. This does not occur on a good many lines of ordinary fabrics, and while it increases somewhat the cost of finishing, it is made possible by the cloth construction. Practically all of these fabrics are made with a comparatively small number of threads and picks per inch, this being necessary because the yarns are quite heavy and the weave does not permit the introduction of any large amount of yarn. Of course, there are nearly twice as many picks in the cloth as would otherwise be possible

BECAUSE OF THE WEAVE USED,

but even this does not make the construction high in comparison with many other cotton fabrics. The waste which is taken out in certain processes of yarn making is often reworked into fabrics such as are described. Sometimes China cotton is used in making filling yarn for such materials, inasmuch as this cotton has a certain amount of harshness which is desirable in making the fabric feel more like wool. Sometimes the filling yarn is made on a mule frame, while the warp yarn is spun on a ring frame, though this is not always the case. The short staple can be handled more satisfactorily on the mule, and the fact that there is little tension when spinning allows a low standard of twist to be used, giving a softer yarn and a more delicate and desirable fabric. In a good many heavy fabrics of

this character a number of heavy ply threads are used on the outside of the selvages, in order to make weaving more satisfactory with the heavy filling. The pull of the filling yarn is so great that it is likely to cause selvage yarn to break unless it is quite strong. Naturally, a box loom is necessary in order to place in the fabric the fillings of different colors. In the large majority of instances two picks of each color of yarn are used in succession.

PROFITS.

During the present season the profits secured from the making of cloth such as is described have been brought to attention about as prominently as for any other cotton fabric. This is because the producing capacity has not been increasing as rapidly as the demand. The profits are also quite large, because the production of the looms is large, due to the comparatively small number of picks per inch. It is relatively one of the best fabrics from a mill standpoint in the domestic market. One of the mill men who already makes fabrics of this character was overheard to say a short time ago that if he were to build a new mill to produce any kind of cotton fabrics, a plant to make blanket cloths would be the kind of a mill he would build. A good many manufacturers of ordinary fancy cloths plan to obtain a profit per yard which will allow them to average about $2 a loom per week. This results in about $100 a loom per year, but it is very likely that comparatively few succeed in obtaining profits which show anything like the amount named. These cotton blanket cloths often show a rate of profit quite a little

IN EXCESS OF $3

a loom per week, and there is not nearly so much difficulty in producing the cloth as there is in producing most lines of fancy materials. There is one advantage which a great many manufacturers overlook but which is of great importance in obtaining profits and it is the few changes which are necessary when fabrics of this character are being made. An ordinary fancy mill is likely to make changes in fabrics at the end of every beam or in a comparatively short time, and the quantities of yarn of a certain size are relatively small, while in a mill making a staple line the yarn sizes for warp and filling do not change, neither does the cloth construction change to any great extent, the only difference being noted in the designs applied to the cloth and the colors or combinations of color which are made. Designing is a much more simple process when the different cloth constructions do not vary widely and the operatives are more familiar with the various processes and difficulties which exist.

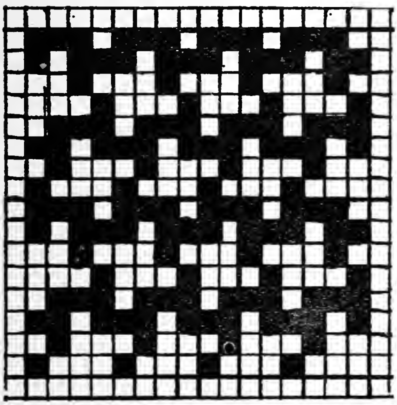
IN A FANCY CLOTH MILL

where constructions and yarns are always changing, difficulties are continually arising, and often there is no basis upon which to consider the various matters, inasmuch as the problem is an entirely new one. When staple lines are being made it is much more possible to obtain an accurate cost for the cloth making, inasmuch as it is a more easy matter to apply the various expense items exactly where they belong. This is absolutely impossible to accomplish on many fancy constructions at least without an expenditure of more money than the saving is worth. One of the features which is of importance in cloth distribution is that prices on these lines may be varied according to the season without so much difficulty occurring as there does on certain of the larger selling lines. A half cent advance on certain ginghams will cause a great deal of discussion among purchasers, while it does not occur so extensively on fabrics such as are described. This material is being distributed at a price which is not ordinarily noted. Most staple lines are made to sell at a certain set price per yard, but this material is evidently constructed in a similar manner to cloths which are used in blankets and is sold at the best price obtainable, and succeeding distributors let it fall into the price at which they can sell it. Thus, fabrics somewhat similar to this one are sell-

ing at 27 cents, 29 cents and in some cases

AS HIGH AS 35 CENTS

per yard. They may or may not be of identical construction, but so far as the consumer is concerned, the appearance is just as desirable at the lower price as it is at the higher one. It may be



Weave Plan.

possible that the fabrics are the same and the different prices noted because of larger purchases or because of different ideas as to what a satisfactory profit should be. The value of the yarns which are used in making blanket fabrics forms by far the largest portion of the total cost. The weaving price per yard is low, due to the small number of picks per inch, and the various expenses per yard are also low due to the same feature. Inasmuch as the yarns are dyed when they reach the loom there is very little finishing necessary, except the napping process.

The method of finding the weights of the yarn and the weight of the cloth is rather simple, but it must be done in a careful manner or else any estimate regarding cloth costs will not be correct. The fact that the cloth has lost quite a little weight in the napping process and that the yarns are actually finer than when they were spun causes a much lighter material with a lower cost for the materials used than when the cloth comes from the loom. The weights of the yarn are obtained as follows:

1,516 ends ÷ (20/1 × 840) = .0902, warp weight without take-up.
9% take-up in weaving.
.0902 ÷ .91 = .0991, total weight of warp per woven yard as it comes from loom.

$$\frac{54 \text{ picks} \times 30'' \text{ width in reed} \times 36''}{36''} = 1{,}620$$

yards of filling per yard of cloth.
1,620 ÷ (5/1 × 840) = .3857, total weight of filling per woven yard as it comes from loom.
.0991 + .3857 = .4848, total weight per yard from loom.
1.0000 ÷ .4848 = 2.06 yards per pound from loom.

PATTERN.

20/1 Am. carded warp $\frac{2}{8}$ 1,484 $\frac{2}{8}$ = 1,516, total ends.
5/1 Am. carded filling; 54 picks per inch.
25 reed, 30" width in reed, 27¾" finished width.
54 × 54 finished count.

YARNS.

	Cotton.	Labor, waste, dyeing, etc.		
20/1 Am. carded; 1" staple; 4½ hank dou. rov.,	13¾c.	7½c.	=	21¼c.
5/1 Am. carded; ⅞" staple; .75 hank single rov.,	13¼c.	10¼c.	=	23½c.

COST.

1,516 ends 20/1 Am. carded warp + 9% take-up	= .0991 @ 21¼c.	=	$ .0211
54 picks 5/1 Am. carded filling	= .3857 @ 23½c.	=	.0907
Weaving			.0163
Expenses			.0178
			$ .1459
Selling			.0058
			$ .1517
Selling price to jobber (about)			$ .1700
Selling price to retailer (about)			.2000
Selling price to consumer (about)			.2900

Jacquard weave.
Yards per pound before napping 2.06.
Yards per pound finished 2.40.

MERCERIZED ETAMINE

Etamines have been used at various times in the past in quite large quantities, though the amount which can be sold depends a good deal upon the style of cloth selling. They are used for almost any purpose where a rather heavy and somewhat open material is desirable, and when they are in demand very satisfactory profits and an extraordinary distribution takes place. For a number of years past there has been very little interest in such fabrics, but it would not be surprising if a greater quantity of these cloths would be soon desirable and another run upon them take place. Possibly the only reason why there has not been a demand for these cloths for some years has been because many voiles are somewhat similar, and many consumers would use them for about the same purposes, and, therefore, has made any great production comparatively impossible.

Due to the great change which mercerization has made in the appearance of various lines of fabrics the etamines which would be produced to-day when mercerized are a much different appearing cloth to those of other years, and some description regarding their method of production would seem desirable. The construction of the cloths will

VARY WIDELY,

just as it will for any other fancy cotton mill product, but, as a general thing, the threads and picks per inch are comparatively few in number and the yarns used of heavy size. Not only are the yarns heavy, but a large percentage of them are of a ply character, possibly the majority being two or three-ply, though there is quite a quantity of these fabrics made in which a greater number of threads are used in making the ply yarn, the cloth under discussion being of this character, as it is made of four-ply yarn, both warp and filling. There are certain features in regard to the production of these cloths which would not ` considered at all by many who are quite well acquainted with cloth making and the manipulation of yarn sizes, and methods of manufacturing are likely to create quite a variation in the cost of production and the selling prices. The fabric analyzed was made from Egyptian cotton and its method of construction creates a high relative cost, but somewhat similar lines can be produced which, to ordinary consumers, might be just about as satisfactory, and at a much lower cost.

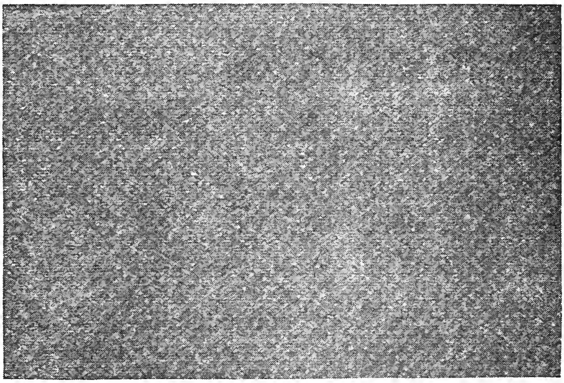
CONSTRUCTION FEATURES.

These fabrics are made from heavy yarns and with a low count, and, therefore, any kind of a fancy weave is seldom employed in their manufacture, inasmuch as any weave creates a loose fabric and the effect does not show up in a very desirable manner. Patterns placed upon heavy cloth are even more unsatisfactory than those placed upon very fine cloth, and everyone knows that usually it is not worth while to make fancy figures upon very fine yarn materials. Due to the low count, a plain weave is practically always employed, as this creates the firmest fabric and gives better results. One feature which is well worth mentioning is that even though plain weave is employed, there is a distinct twill effect noted upon the finished cloth, this being caused by the heavy character of the yarn as the various threads interweave back and forth. At one time it was considered necessary to make any kind of yarn which was to be mercerized, either before or after weaving, out of Egyptian cotton, in order to get satisfactory results. This is not so true to-day, for the improvement in mercerization has been so great that practically as good results can be obtained from 1⅛-inch cotton to-day, as could be obtained 10 years ago from 1⅜-inch cotton. The saving in this one feature alone is of great importance, and while we have given the cost of the cloth as made, nevertheless it is entirely probable that most manufacturers would make the cloth analyzed from American cotton of a much shorter staple. Shorter cotton costs less and in addition creates a much

SMALLER LOSS FOR WASTE,

not only because of lower price, but also because there is likely to be a

smaller percentage of short fibres in cotton of shorter length. There is a very great difference in appearance noted in various etamine cloths caused by the irregularity in the threads and picks per inch, but there is also a great difference in appearance which is caused by the number of threads used in the ply yarn, and in the amount of twist per inch which is inserted. In the fabric analyzed the amount of twist and the number of threads in the ply yarn have a distinct influence upon the result, because the twist in the yarn seems to form small checked patterns which are seldom visible in any other kind of a finished fabric, and sometimes are very desirable. Until the cloth is examined and analyzed it would seem as if there was a very much higher count than actually exists. The direction of twist in the ply yarn also has an influence on the result, because when both warp and filling are twisted in the same direction the various squares seem more prominent, whereas when the warp is twisted in one direction, and the filling in an opposite direction the various threads in the ply yarn seem to correspond more closely in the warp and filling, and the small squares do not appear so prominent.



Mercerized Etamine.

METHODS OF PRODUCTION.

There are quite a number of ways in which a dyed and mercerized etamine can be produced and these various methods have quite an influence upon the cost of production. First, the fabric can be made from yarns which have been mercerized and dyed before they are woven. In this case no finishing is necessary, as the term is ordinarily known when speaking of grey cloth. Second, the fabric can be made entirely from grey yarns and then piece-dyed and mercerized. This method in some fabrics gives a lower cost and just as desirable results, but it is questionable whether it would give as desirable results in the cloth analyzed, although it undoubtedly would cause a lower cost. In this connection it might be well to state that both the warp and filling are mercerized in this cloth, whereas in many fabrics only the warp or the filling, as the case may be, is the portion which shows the mercerization effects.

The improvement in mercerization during the past few years has made this method much more satisfactory than it previously was, and for many fabrics of the character described, no other method could be adopted. Third, this method consists of using yarn which has been mercerized but not dyed before the weaving operation. When the weaving is completed the grey fabric made from mercerized yarns is bleached and then piece-dyed in whatever color seems most desirable. This method, while being

somewhat more expensive than the second method described, is, nevertheless, responsible for the warp and filling having exactly the same amount of luster, a feature which is sometimes of importance where warp and filling are both as prominent as in the cloth considered. In any of these methods of construction there is very little difference in the actual cloth production, for the yarn is strong enough so that practically no breakages occur in weaving, the operation of changing shuttles being the one which consumes practically the entire time of the operative. If such cloths are to be produced in quite large quantities, and more or less continuously, it is a very good plan to adopt methods whereby a large amount of yarn can be placed upon the filling bobbins, so as to make the loss from shuttle changing as small as possible, and also to make as large a number of looms per weaver as possible. Even though this be done the number of looms which can be operated is somewhat smaller than for most other fabrics.

PLY YARN MAKING.

Many might consider that the making of ply yarns is a simple matter, and this is often true for medium sizes of such yarns where only two ground threads are used, but difficulties increase as the number of ground threads are increased and as the necessity becomes greater for all of these various threads to be present in the finished ply yarn. In a good many mills stop motions are used where two-ply yarns are made, which stop the operation of the rolls when one end breaks. In other plants it is the custom to make the twist in the yarn such an amount that if one thread breaks down the untwisting of the remaining thread will be enough for the traveler to break down the thread which remains. When three or more ground threads are being twisted the breaking of one will not stop the twisting operation, and whenever an operative is looking after quite a number of spindles it might be that the ply yarn was made for some time with one of the ground threads missing. Whenever this occurs, and this yarn is not eliminated, it is likely to cause streaks in the cloth, and spoil otherwise valuable material.

SECONDS CAUSE LOSSES.

Any large amount of seconds in fancy cloth may cause large losses, which make the production of such fabrics much less desirable than costs indicate, inasmuch as seconds cannot be sold at anything like the price for firsts when any large quantity is made. To obviate any difficulty when ply yarns are being made certain machines have been developed which place together the various ground threads, but do not insert any twist whatever. On these frames there is a stop motion on every ground thread, which makes it certain that the ply yarn which is produced will always contain the correct number of threads. When spools are filled with these ply threads which are not twisted, they are taken to the twisting frame and the correct amount of twist inserted, but all the threads in the ply yarn come off of a single spool upon the twisting frame instead of coming off of three, four or more spools as the case may be. Although the cost of placing these yarns upon a spool is relatively high, nevertheless the results obtained in a lower twisting cost and in a smaller number of seconds more than warrants the installation of such a process, at least where anything but the cheapest cloth is being produced.

ANOTHER FEATURE

which is of importance in yarn production is that a high percentage of production should be obtained, largely because a long staple of cotton is used for a relatively coarse size of yarn. There are very few fabrics where anything over one-inch staple would be used for a yarn which is as coarse as 16-1. It is also possible to make yarn with a lower standard of twist than that normally used, just because the staple is longer than necessary for the size of yarn being made. This lower standard of twist is of importance, inasmuch as it makes a greater amount of luster when the yarn is mercerized. The less twist there is in yarn or the straighter the various cot-

ton fibres lie when woven, the better is the result produced when the yarn or cloth is mercerized. This is why soft twist yarn is used in the warp when warp yarn is mercerized in cloths similar to poplins, and is also the reason why soft twist filling yarn is used in mercerized shirting fabrics of a wide variety.

BALANCE OF ORGANIZATION.

There are a great many problems which come up when different kinds of fancy cotton fabrics are being produced, but none of them have any more serious effect upon profits than the correct balance of the whole plant. This subject is not considered carefully enough by a good many mill men and possibly by a majority of those who sell the cloth, inasmuch as they often know very little regarding the actual effect which the accepting of any order will have on the operation of the various machines. Take a fabric like that analyzed for an example when it has been produced from a cotton such as that noted. Up to the roving machinery the methods employed will be somewhat similar to those ordinarily seen when medium or fine yarns are to be made. At the point mentioned a great difference is noted, for few fly-frame processes are necessary, and the roving instead of being of fine size in order to make fine yarns must be of coarse size to give the best results.

On the spinning frame the production instead of being small, as would be noted for the length of cotton being used, is quite large, due to the low count of yarn and also to the somewhat lower than normal standard of twist. If this coarse yarn is made on a spinning frame which has been running on coarse yarns, that is, a frame with rings of quite good size, the spinning frame rolls will have to be reset in order to handle a longer staple of cotton. If frames with small rings only are available then there are difficulties because of the small amount which a bobbin will hold. Due to the large production on the spinning frame, a relatively small number of spindles in comparison to carding and other machinery is necessary, and often the making of such yarn will cause idle spinning machinery. Due to the coarse size of roving necessary one and sometimes more processes of fly-frames are eliminated, and usually there is no other work to keep such idle machinery in operation. The

STRENGTH OF THE YARN

and other conditions permit of large production on machines which succeed the spinning frame, and this causes stoppage of machinery and other difficulties. There are many mill men who never consider idle machinery in the cost of any cloth, and while this is a difficult problem, nevertheless there are a good many cloths on which some provision should be made if anything like correct results are to be obtained. If one-third of the spinning machinery is idle, the remainder must earn large enough profits to make the dividends of a satisfactory character.

Another feature which must be considered when a cloth such as that analyzed is being made is that the yarn will have to be spun and twisted and then shipped to some other plant to be mercerized in the majority of instances. This will make delivery dates uncertain and will increase the cost of production quite radically if the yarn does not happen to be available at the time necessary. This has been one of the main reasons why certain silk sellers have been able to obtain a large portion of the silk business of cotton mills, for they keep silk always available, so that no machinery is idle. Of course, it is the duty of the seller to see that ample provision is made when orders are accepted, but unsatisfactory delivery causes many troubles, and even if damage suits are instituted they seldom compensate for losses which are incurred. When fabrics vary radically from season to season, and from month to month, or when every order may be of a different character, it takes a

GREAT DEAL OF ABILITY

on the part of a seller to keep machinery operating in full. Sometimes it is a good plan to sell certain fabrics at cost when they are necessary for economical operation of the plant instead of accepting orders for some other kind of fabric which ordinarily would

show a satisfactory profit. Recently this organization problem has been illustrated clearly by conditions in many fine goods mills. In these plants not over 80 per cent of the looms and some other machinery have been operating, while cards and certain other machines have been running full and in some cases overtime. Not only is an intimate knowledge of mills in general and the one sold in particular necessary, if the best profit be secured, but it is also necessary to have accurate records kept regarding the various machines in the plant. Unless this be done trouble will surely result with delivery dates uncertain and friction between buyers and sellers.

THE OBTAINING OF PROFITS.

One feature which has not been brought to attention during recent years has been that a large proportion of the cloths made have been of rather low constructions. This fact has allowed quite a large production to occur on the looms, and makes satisfactory mill dividends when a very small profit per yard is secured. Take voiles for an example. On many of these fabrics one-half to three-quarters of a cent per yard would be responsible for an excellent mill showing, while on certain kinds of sateens and shirtings, the same amount of profit per yard would be rather unsatisfactory from a mill standpoint.

With competition as keen as it has been and the demand in yardage rather subnormal, there would not have been as satisfactory a mill condition as exists to-day, if higher constructed fabrics have been in demand. It is also probable that the number of looms which have been operating have been able to produce as many, if not more, yards of cloth than was formerly produced when operating in full. Although the percentage of production is not quite as high when some of the low pick materials are being made, nevertheless the construction of the cloth has been responsible for a distinct gain in yardage per loom obtained. Take the cloth analyzed. This has only 24 picks per inch when woven, and this fact makes it possible for a very large yardage per loom to be obtained in comparison to many of the fancy fabrics which have sometimes been in demand. Even when compared with voiles and crepes, the production is quite a little larger in yards produced. Due to the above fact the amount of profit per yard necessary to pay a reasonable dividend seems incredibly small, when compared with the profits which retailers and others often find to be necessary.

We have given the cost of making the fabric analyzed and its approximate selling prices. It is entirely probable that a construction of a similar character could be made from shorter cotton and sold to retail at 35 cents per yard, or even less. To a consumer such a construction would be just as desirable as that analyzed. In fact, it is questionable whether the cotton used in this fabric adds anything whatever to the finished result. This question of cotton for any fabric is one which has never been considered as carefully as it might be.

A subject which in some cases

CAUSES DIFFICULTIES

is the fact that ply yarns may shrink or stretch according to the twist which is being inserted. If a single yarn sizes 20-1 and when twisted two ply sizes relatively 9.5-1, it makes a lot of difference in the cost of the cloth than if it sized 10.5-1. If either occurs and provision is not made for it the proper cost is not obtained, and if the cloth is heavy the profit figured is not being obtained, while if the cloth is light an extra profit is being secured. Some manufacturers spin their single yarns so as to produce a certain size of yarn when they are twisted and in this case the problem is very simple. When this ply yarn variation has been satisfactorily settled the method of finding the weights of yarn and cloth is very simple, and is as follows:

720 ends ÷ (16/4 × 840) = .2143, weight of warp per yard without take-up.
7% take-up in weaving.
.2143 ÷ .93 = .2304, total weight of warp yarn per woven yard.

$$\frac{24 \text{ picks} \times 29\frac{1}{2}'' \text{ reed width} \times 36''}{36''} = 708$$

yds. of filling per woven yard.
708 ÷ (16/4 × 840) = .2107, total weight of filling per woven yard.
.2304 + .2107 = .4411, total weight per yard.
1.0000 ÷ .4411 = 2.27 yards per pound **(grey)**.

PATTERN.

16/4 Eg. mercerized warp 12 696 12 = 720, total ends.
16/4 Eg. mercerized filling. 24 picks.
24 reed; 29½" width in reed, 28" grey width, 27" finished width.
26 × 23 finished count.

YARN.

	Cotton.	Labor, waste, twisting, mercerizing, etc.	
16/4 Eg. combed warp and filling; 1⅜" sta.; 3¼ hank dou. rov.,	22c.	16¾c.	= 38¾c.

CLOTH COST.

720 ends 16/4 Eg. combed mercerized warp + 7% take-up...= .2143 @ 38¾c.	=	$ .0831
24 picks 16/4 Eg. combed mercerized filling................= .2107 @ 38¾c.	=	.0817
Weaving		.0064
Expenses		.0052
		$ .1764
Selling (grey)		.0035
		$ .1799
Mill selling price (approximately)		$ .1775
Finishing, dyeing, etc.		.0150
		$ .1925
Converter's price (about)		$ .2750
Jobber's price (about)		.3250
Retailer's price		.4600

Yards per pound 2.27 (grey).
Plain weave.

LENO CLIPPED SPOT DRESS GOODS

There is one line of cloth which is made in quite wide variety and which in a general way is of a light character, having a more or less regular distribution, though seldom mentioned. In a good many instances, such fabrics are known by special names which are likely to change in different seasons, but to a manufacturer they are known as a fine yarn box loom and leno product. The ground constructions of the fabrics do not vary widely from season to season, though the effects may differ quite radically. They are used for

WAISTINGS AND DRESSES

of various kinds, and although the orders are for smaller quantities than a good many manufacturers usually produce, neverth less they are one of the fabrics which should form a portion of the staple business of a fancy mill using fine yarns. They do not require machinery of an especially complicated character, for they can be made on an ordinary dobby loom, which is equipped with a box motion for the introduction of heavy filling. As previously mentioned, the cloths are

MADE FROM YARNS

which would be considered of fine character by the majority of manufacturers. This is necessary because the effects produced are made through the contrast of a fine ground fabric with heavy woven figures. Naturally, yarns of quite good quality are essential if the effects produced be satisfactory, for any great amount of irregularity in fine yarns is particularly noticeable when woven into cloth, especially if that cloth be largely woven with plain weave.

HEAVY YARN

is usually necessary for the heavy spots, because this creates a distinct contrast with the light and semitransparent ground. In some cases the yarn which forms the spots, or the extra filling yarn, is of a dyed character, but in other cases it is entirely white, and probably the greatest portion of these cloths are made and sold in a white state. The introduction of leno effects, even though of a very simple character, sometimes

ADDS A GREAT DEAL

to the attractiveness of the result, inasmuch as it makes possible an en-

tirely different effect, and creates an impression of a much more open fabric than actually exists. Sometimes changes can be made very easily in the patterns produced, and it is not always necessary to redraw warps or to have a different cloth construction in order to obtain various effects. This is noted because the warp is made entirely from one kind of yarn, whereas the

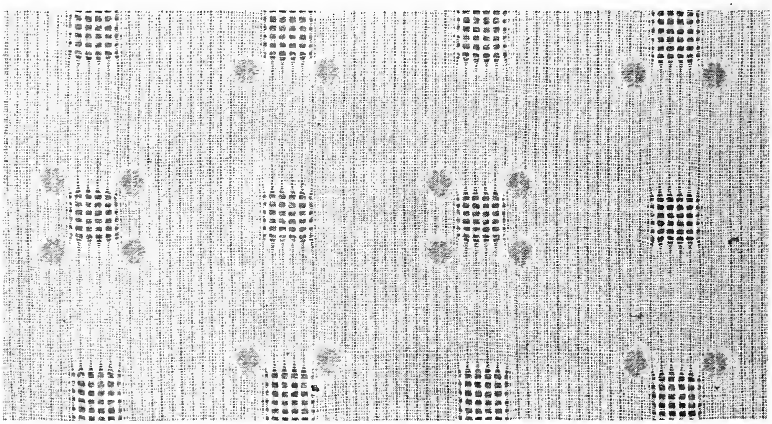
BOX LOOM MOTION

is responsible for the figure and can be changed much easier than if the pattern were made in the warp. Effects in great variety are made by the combination of the two weaves mentioned, and it forms the basis for a large sale of what might be termed

the cotton which is used for any size of yarn must be longer than when grey yarns are being used and often very different methods have to be used in order to obtain satisfactory results. When new dyestuffs were developed, which would stand the bleaching process, it made possible another method of production, which undoubtedly gives a

LOWER COST

of production, and eliminates certain of the difficulties and many of the processes previously necessary. This does not mean that all manufacturers have adopted such a method to-day, but it means that an increasing number of such cloths will be made from grey yarns and with fast color spots.



Leno Clipped Spot Dress Goods.

one of the fanciest varieties of cotton fabric made with ordinary equipment.

Until a few years ago it was possible to make effects such as are seen in the sample analyzed in only one manner, this being through the use of bleached and dyed yarns. Few manufacturers of fabrics realize the difficulties which exist when fine yarns are bleached, dyed, and then woven into fabrics. In the first place, the various processes which are necessary make the cost of such cloths excessive, and limit the sale to a great extent. For another thing,

The reason for this is that the use of grey yarns, which are stronger than when bleached and handled, gives a greater percentage of production and a lower cost. It eliminates many of the troubles which occur when

FINE BLEACHED YARNS

are used, and, in a good many instances, is undoubtedly responsible for a much better finished fabric. For practically all fabrics, such as are being described, a plain weave ground is used, because fine yarns would slip badly with a low construction if any

woven figure were used. Then, woven figures do not show any great contrast and are not especially effective when made entirely from fine yarn, and with no heavy yarns used in addition.

FIRMNESS

is also an essential characteristic in any fabric which is to be used for dress goods, and to give this firmness with a low count it is necessary to use plain weave, or at least some simple weave. Inasmuch as most of the simple weaves do not show any particularly desirable effects on fine cloths, it happens that plain weave practically always forms the ground. All of these light fabrics are, however, fabrics in which

STRONG CONTRAST

usually exists, and these contrasts are brought about by the fine yarn ground and the heavy spots or figures which are made by the box loom motion. The introduction of various small leno figures is desirable, inasmuch as they offer some contrast to the ground cloth. Due to their small nature, it does not slip badly and so is satisfactory. One of the noticeable features in these cloths is the way the effects are produced. The arrangement of the leno and heavy yarn figures is often responsible for the success or failure of any pattern, and the combination of them produces effects which to many seem more complicated than most other kinds of woven cloth. These kinds of cloths are being developed quite extensively in foreign mills at present, with allover figures and with leno and plain weave grounds. Undoubtedly domestic mills will attempt to produce fabrics somewhat similar, but they are

NOT EQUIPPED

at all extensively with jacquards in combination with the leno attachment, and for this reason the figures possible are very limited. It only requires ten harnesses for the production of the box loom spot, and these, in addition to the harnesses which weave leno and those which form the plain ground, complete the number necessary. In many of such fabrics it is only essential to have two harnesses for plain weave, inasmuch as the leno and box loom portions of the cloth

ELIMINATE DIFFICULTIES

from overcrowding of heddles on the ground fabric harnesses. The warp yarn would have to be placed upon two different beams in order to be woven satisfactorily, inasmuch as the leno portion is likely to have a different pick-up than that portion where ground cloth is being made. In some kinds of leno it is necessary to have two beams extra for the leno, but in this case it is not necessary, as the ground and crossing threads in the leno take up identical amounts.

INGENUITY IN DEVELOPING.

Just how the fabric is developed will have a large amount of influence upon the results obtained, and this is one reason why a certain portion of the foreign fabrics made show better results. Domestic makers are very liable to slight fabric details when they are developing ideas, and consider quantity of more importance than quality. This, however, is not of advantage when it comes to selling cloth, neither does it aid very much in getting off the

LARGEST PERCENTAGE

of production. In the fabric considered, it is necessary to use a reed where four ends are drawn in dent because of the leno weave. Of course, it would be possible to use a 36-reed, and wherever the leno is made, to remove the wire so that there would be four ends per dent, but this practice spoils the reed and is not especially desirable where small quantities of any fabric are to be made. In addition to spoiling the reed other

UNDESIRABLE RESULTS

would be produced, which would not be considered of importance by those not experienced. In a cloth like that analyzed if one portion contains four ends per dent, and another portion two ends per dent, the reed marks would not be so prominent in one part as in another part of the cloth, and buyers would object to the streaky ap-

pearance produced. They would criticize the results, and it would be

VERY HARD TO EXPLAIN

why the same effect could not be produced throughout the entire fabric. Under such conditions it is better to have the whole fabric showing prominent reed marks than it is to have only one portion of the cloth particularly noticeable in this direction. This is the reason why an 18-reed was used with four ends per dent rather than a 36-reed with the ground portion drawn in two threads per dent. It makes a great deal of difference where the

HEAVY SPOTS

are introduced into the cloth, and it is one of the most important things when developing a cloth to introduce these spots where they will show up well, and, in addition, where they will cause little difficulty in the weaving operation. The operation of the leno threads and the introduction of heavy filling in one portion of a fabric and not in other portions is very likely to cause very bad streaks; in fact, in some patterns it is

ABSOLUTELY IMPOSSIBLE

to eliminate some of the bad features. Whenever such cloths are being woven, careful weaving and loom setting will be responsible for a great difference in the effect produced. In order to aid in obtaining a regular ground cloth, it is the usual practice to use heavy filling with soft twist, either in single yarn or when 2-ply is used. A low standard of twist allows the ground picks to be driven in closer, and helps to eliminate the tendencies to streakiness.

THICK AND THIN PLACES

are one of the greatest difficulties noted when fine yarn fabrics decorated with heavy spots are being made. It is necessary to lift the take-up pawl so that the cloth will not weave down and leave a thin place when the heavy yarn is being inserted. It often happens that the pawl must be raised before the heavy filling is inserted, in order to eliminate difficulty, and sometimes the pawl is raised many more times at the start of a spot than it is when the last portion of the figure is being made.

MECHANICAL DIFFICULTIES

and the variation in yarn and pattern are responsible for this practice, and any difficulties are usually adjusted at the loom in order to produce the best effect possible. Because this take-up pawl is raised the number of picks per inch are greater than the pick gear used would indicate. To get the average number of picks per inch sometimes causes a good deal of difficulty, because the take-up in the fabric may vary somewhat. The

VARIOUS LENO THREADS

operate in a plain manner when they are not crossing back and forth. In each leno effect there are four threads, and when open work is being made two of these threads cross over the remaining two threads and stay in their position while three picks are being inserted. To anyone who is at all familiar with leno work, the method of producing such a weave is very simple. It only requires that the two crossing threads be drawn

THROUGH THE LOOP

of the doup instead of the single heavy end so often noted. Instead of having these two crossing threads operate with one or more ground threads, they operate upon two ground threads which, when leno is not being made, weave in a plain manner. One feature which is worth noting is that the cloth is practically always woven face down. This is done because it allows a

MUCH SMALLER PORTION

of the warp yarn to be lifted when the figure is being made than if the cloth were woven face up. The lifting up of a smaller portion of the face yarn is likely to eliminate a portion of the streaking tendencies. This cloth and many others of a similar character can be woven with the face up, but it is seldom made in this manner. One objection to weaving a fabric face down is that it does not permit the operative to see the portion of the cloth which is to be the face when finished, and as everyone knows, there are often places which

can be improved by the operative when seen, but which often slip by when they are on the back of the cloth.

PROCESSES AFTER WEAVING.

A process which is seldom noted on ordinary cotton fabrics, but which is necessary in order to create attractive results on fabrics such as that analyzed, is the shearing of the heavy yarn from the fabric, when it is not producing a figure on the face of the cloth. The heavy filling floats from one figure to the next repeat across the width of the fabric, and these long floats would be very undesirable to consumers when made into a garment. To eliminate this difficulty they are

CLIPPED OFF

by machine. Manufacturers much prefer to produce clipped spots by the box loom method, inasmuch as it is a comparatively easy process to cut off filling floats when the cloth is woven. As the cloth passes through the machine it is much easier for the knives to be inserted under filling floats than under warp floats. One of the great difficulties in making certain kinds of clipped spot figures is to get the various floats long enough so that the knives can operate. In most cases it is necessary to give the fabric

A NUMBER OF RUNS

upon the shearing machine, in order to get the spots properly sheared. In a good many instances, the first process merely consists in cutting the various floats, and succeeding processes brush up the clipped ends and permit the shears to cut the ends down close to the woven figure. The arrangement of the pattern has much to do with the success of the shearing operation. When detached small figures are made, there is usually little difficulty, but where large allover figures are woven there are likely to be small places where the knives will not work and the openwork effects are not produced.

REGULATING PROFITS.

All of these various fabrics must be made carefully and in addition sold carefully, if the best results be secured, and if a satisfactory profit be made. The production in yards is comparatively small per loom, because it is box loom work where a low loom speed is noted, and, in addition, the percentage of production is likely to be radically lower than for ordinary fabrics, because of

THE LENO MOTION

with the use of fine yarns. These fabrics are ones where information in regard to particular fabrics is of value, for various small features have a great influence upon the cost of production. The use of good cotton is always to be recommended, because the costs for material are relatively small, and the costs for labor relatively high. Sometimes the introduction of a longer cotton will save much more than its cost through greater percentage of production at the loom. This is regardless of the fact that better yarn and better cloth are made, and a

BETTER FINISHED RESULT

produced. Sometimes the use of better yarn will permit a greater number of looms per operative to be run. The fact that quite a little leno is used, together with the box loom motion, makes it necessary for many fewer looms per operative to be noted, and this increases the cost of weaving quite radically. A good many manufacturers do not like to make such fabrics for this very reason, inasmuch as it makes many more weavers necessary for the number of looms operated and these weavers are

NOT ALWAYS AVAILABLE

and any further change in fabric style makes them again unnecessary. This brings up the fact that an experienced seller will manipulate the orders received in such a manner as to keep all of the help employed continually, this being of great importance when profits are concerned. When fabrics vary widely in character, it is absolutely necessary to have some reasonably accurate method of obtaining the cost, and where the number of picks per inch

WILL DIFFER WIDELY,

and yarn sizes of a variable nature be used, the average production method so often noted is certain to give inaccurate results. The cloths are usually

finished in a crisp manner, but there is comparatively little difficulty when the cloth is woven and sheared. Due to the fine character of the yarns there is a very small take-up in the weaving process, and there is also a much smaller shrinkage in width than for other heavier fabrics where the yarn shows a greater amount of curvature. One of the most difficult problems when

ANALYZING A FABRIC

of this character is to estimate the size of the yarn which has been used for making the clipped spots. Whenever wide figures are made, it is usually possible to take from the fabric pieces of heavy yarn which can be easily compared with others and be estimated quite accurately. But when the figures are very small, this is not so easy, and the estimated yarn size may vary from what was actually used. When this has been accomplished, there is

NO GREAT DIFFICULTY

in obtaining the cloth weight as it comes from the loom. Few care about the weight in a finished state, and for this reason the weight is seldom obtained when the fabric has been sheared. To find the average yarn size upon which the new rates of duty are ascertained is not so easy a problem as many have considered it to be, and there is likely to be a great amount of trouble when average yarn sizes for such cloths come anywhere near the dividing line. Due to the

VARIATION IN SHEARING

and other features, there are likely to be no two portions of the cloth similar, and no average obtained which will be at all accurate. The method

PATTERN.

60/1 Am. combed warp $\frac{2}{12}$ 2,144 $\frac{2}{12}$ = 2,192, total ends.
75/1 Am. combed filling. 70 picks ground.
40/2 Am. combed filling. 16½ picks figure. Dyed.
18 reed; 30" width in reed; 28½" finished width.
76 × 86½ over all finished count.

YARNS.

	Cotton.	Labor, waste, twisting, dyeing, etc.		
60/1 Am. combed; 1⅜" sta.; 12 hank dou. rov.,	22c.	19½c.	=	41½c.
75/1 Am. combed; 1⅜" sta.; 17 hank dou. rov.,	22c.	21c.	=	43c.
40/2 Am. combed; 1⅛" sta.; 8 hank dou. rov.,	16½c.	28¼c.	=	44¾c.

COST.

2,192 ends 60/1 Am. combed warp + 5% take-up	= .0458	@ 41½c.	=	$ .0190
70 picks 75/1 Am. combed filling	= .0333	@ 43c.	=	.0143
16½ picks 40/2 Am. combed filling, dyed	= .0295	@ 44¾c.	=	.0132
Weaving				.0522
Expenses				.0227
				$ .1214
Shearing				.0025
Selling (grey)				.0028
Mill cost (grey)				$ .1267
Selling price (about)				$ .1500
Bleaching, finishing, etc.				.0125
				$ .1625
Converter's expenses				.0200
Cost to converter				$ .1825
Selling price, converter (about)				$ .2400
Selling price, jobber (about)				.3000
Selling price, retailer				.4600

Yards per pound, 9.21 (grey) before shearing.
Reeded 4 ends per dent.

of obtaining the weights of the yarn and cloth is as follows:

2,192 ends ÷ (60/1 × 840) = .0435, weight of warp without take-up.
5% average take-up in warp.
.0435 ÷ .95 = .0458, total weight of warp per woven yard.

$$\frac{70 \text{ picks} \times 30'' \text{ reed width} \times 36''}{36''} = 2{,}100 \text{ yds.}$$

of fine filling per yard of cloth.
2,100 ÷ (75/1 × 840) = .0333, total weight of fine filling per yard of cloth.

$$\frac{16.5 \text{ picks} \times 30'' \text{ reed width} \times 36''}{36''} = 495 \text{ yds.}$$

of heavy filling per yard of cloth.
495 ÷ (40/2 × 840) = .0295, total weight of heavy filling per yard of cloth.
.0458 + .0333 + .0295 = .1086, total weight per yard.
1.0000 ÷ .1086 = 9.21 yards per pound, before shearing.

FANCY LENO STRIPE

Leno fabrics are ones which are more or less open, and are used for different purposes. They have been used quite extensively in the past, but for five years or so, there has been little call for cloths of this character. The past season has seen an increasing demand for these fabrics, and there have been produced many variations of this weave. At present the weave is used for narrow stripes on men's shirtings and ladies' waistings, in check effects for waistings, in plain all-over leno for overdresses and many other combinations in various fabrics.

The weave is made by having ends twist around one or more other ends, thus giving in some cases a wave effect, or in the cloth we are considering

AN OPENWORK EFFECT.

The twisting of the ends is made possible by an arrangement on the loom which permits the leno or crossing end to pass from one side to the other of the ground end or ends, as the case may be. Because of this crossing back and forth, the loom is run at a speed somewhat slower than on ordinary work. To make this crossing possible, the crossing end or leno end is run through a doup which is attached to a harness on which there are no heddles. These doups, which are usually made of good hard-twisted worsted yarn, are passed through the eye in a second harness. By raising a back harness this slips the doup up through the eye to make the crossing on one side of the ground ends, and by raising the harness and doup both, it makes a crossing on the opposite side of the ground end or ends. This is the simplest leno weave which is produced, and it is called

GAUZE.

It is composed by having two ends which cross each other at every pick, and from this foundation idea many beautiful effects in weave and color are produced, for there are leno motions which are attached to jacquard looms also, giving a leno weave in a jacquard pattern all over the cloth.

Because these doups wear out, thus requiring much care in some cases, fewer looms are given a weaver to run and this, of course, makes the weaving price high for this kind of cloth. It is to be noticed that we have allowed 2 looms to a weaver, although in some mills more are given than this on a fabric similar to the one we have analyzed. In these fabrics the amount of yarn used is rather small—in the cloth we are considering less than 2½ cents of the total 8 cents grey cost—so any amount saved would naturally be taken off the labor cost, and in these classes of fabrics it is the production and economy in labor that make the largest reduction in the fabric costs.

On our drawing-in draft it will be noticed that we have marked some dents with ciphers, and this means that no ends are drawn in, or rather needed, in these dents, and the reason why the ends do not all slip together when woven is because of the twist given by the leno weave. The filling on a fabric of this character is nearly straight, so that the finished width and grey width are identical in many cases, and sometimes the finished width is wider than the grey width.

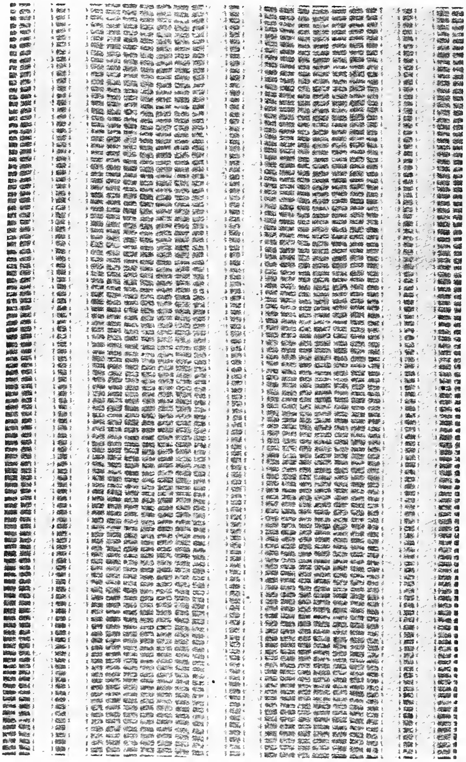
To obtain the result wanted sometimes means a lot of experimenting at the mill, because in many cases the cloth is wanted at a certain price, and until some of the cloth is woven, it is very hard to tell just how the fabric will look, as the size of the yarn and

the kind of reed used and also the number of picks affect the looks of the cloth to a certain extent.

NOT CONSIDERING THE PRICE.

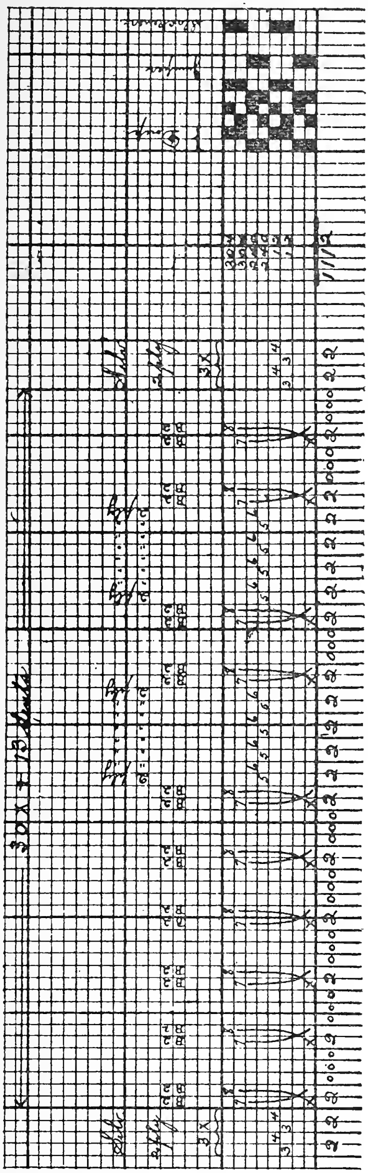
Some of these cloths are being made to-day by mills which have never before attempted to make them, and we would say that if they did consider the cost of making they would be more careful of the price at which they sold. We have personally seen leno cloths within a very short time which were sold by the mills at $5\frac{1}{4}$ cents per yard which surely could not be produced at anywhere near this figure. The mills which sold them had never had much experience in making leno cloths, and we should say that, before the order is completed (it is a rather large order for this grade of cloth), they will surely wish they had never touched it at the price. This point should be carefully considered by mill treasurers, and before a new cloth is sold, some idea of the cost to make should be obtained, for, in many cases, a mill treasurer is as much at sea regarding the cost to make as a buyer is.

The take-up on the leno ends in this cloth is rather small, but in many cases of ordinary leno work the take-up will be from 25 to 40 per cent, and in a Russian cord the take-up will be about 75 to 80 per cent, or in other words, for 1 inch of cloth 5 inches of yarn will be required for the crossing or leno end. These Russian cords which are just ordinary leno, are being used very extensively as stripes in



Leno Overdress Fabric.

fast colors in men's shirting material.



Draft and Cnain.

A pattern is laid out for a leno such as we are considering, as if it were plain weave instead of openwork stripes. By comparison of the plain stripes and leno we find that a 44 reed was used, and by pulling out some filling we make the reed width 29¼ inches.

44 reed × 29¼ inches = 1,287 dents total.
1,287 — 12 selvages = 1,275 dents inside selvages.
1,275 ÷ 42 in a repeat = 30 repeats + 15 dents.

To find the place to start our drawing-in draft so that the pattern will perfectly balance, we will proceed as follows: Add the number of dents in the wide stripe and the number of dents left over, and divide by two; this gives the number of dents to start the drawing-in draft ahead of the double stripe.

29 + 15 = 44.
44 ÷ 2 = 22 dents to start ahead of stripe.

If we consider the cloth we will find that a leno is next the selvage so instead of using 22 dents to start we will use 21 dents, which will bring a leno next the selvage. This is done because some dents are skipped, as we stated above, in our reed, and if we leave out one dent on each side, we will have 30 repeats plus 13 dents, which is the way we have laid out our drawing-in draft. By

EXAMINING THE DRAFT

carefully it will be noticed that the two leno ends are crossed on the draft, and this shows to the girls who draw in the warps that one end is to be crossed over and drawn into the doup.

In figuring the yards per pound we will proceed as follows:

1,008 ends ÷ (840 × 60) = .0200, weight of 60/1 in 1 yard of cloth without take-up.
.0200 ÷ .96 = .0208, weight of 60/1 in 1 yard of cloth with take-up.
608 ends ÷ (840 × 30) = .0241, weight of 60/2 without take-up.
.0241 ÷ .88 = .0274, weight of 60/2 in 1 yard of cloth with take-up.

$$\frac{56 \text{ picks} \times 29\tfrac{1}{4}'' \times 36}{36} = 1{,}638 \text{ yards of filling in 1 yard of cloth.}$$

1,638 ÷ (840 × 90) = .0217, weight of 90/1 in 1 yard of cloth.
.0208 + .0274 + .0217 = .0699, total weight of 1 yard of cloth.
1.0000 ÷ .0699 = 14.31 yards per pound.

The count we have given is the

over-all count, because of the fact that so many dents are skipped in our reeding-in plan. The ends in the crowded stripes are drawn in two-ply, as may be seen from our pattern plan. It will also be noticed that the picks are placed in the cloth 2 in a shed. This is probably done because it would be impossible to weave a cloth with 54 picks per inch and have the leno change every pick. In other words, there would be so many crossing places that the cloth would not hold that number of picks. Of course, more picks could be put into the cloth if a finer yarn was used for the 60-2, but with 60-2 warp the picks seldom run higher than 34 or 36 per inch, if the leno ends change every pick. The cloth is woven with doups, which are tied to the bottom of the loose harness and are, therefore, called

BOTTOM DOUPS.

On harness No. 2 is an arrangement whereby harness No. 1 is raised when No. 2 raises. This is necessary, because the doup passes through the heddle eye on harness No. 2, and if No. 1 harness did not raise at the same time No. 2 did, it would either break the doups or keep No. 2 harness from lifting. In some places these two harnesses are not hitched together, and in this case, harness No. 1 would have to be lifted continually on our head chain. In either case, the result is the same, for on the loom our harness No. 1 lifts continually, although the chain does not show it.

Over No. 7 harness we have marked the word "jumper". This is an arrangement put on the loom which raises this harness part way up. This is done to straighten out the doups as it slips them back through the heddle eye and stops them snarling up. This arrangement is used for a double lift dobby, for on a single lift loom where all the harnesses come to a bottom shed the doups naturally slip back into place, and this arrangement is not necessary. We have also marked the word "slackener" over some pegs in the harness chain. These pegs are usually placed behind the regular harness chain on a harness which is not being used, and the purpose is this: When the leno or crossing threads are in a crossed position they twist around the ground threads, and unless some provision is made to let off a little extra yarn at this time, the ground

LENO OVERDRESS.

PATTERN.

60/1 American combed...	$\frac{2}{12}$		$\frac{2}{8}$		$\frac{2}{8}$			$\frac{2}{12}$	= 1,008 beam 1
60/2 American combed.		12		4		4	8		= 608 beam 2
		$\underbrace{\qquad\qquad\qquad\qquad}_{30 \times}$							1,616 total ends.

90/1 American combed filling. 56 picks.
44 reed; 29¼" width in reed; 28" grey width; 28" finished width. 57 × 56 (grey count over all). 57 × 54 (finished count over all).

YARNS.

	Cotton.	Labor, waste.	Twisting.		
60/1 Am. combed, 1⅜" sta.; 12 hank dou. rov.,	26c.	18c.		=	44c.
60/2 Am. combed, 1⅜" sta.; 12 hank dou. rov.,	26c.	18c.	4c.	=	48c.
90/1 Am. combed, 1⅜" sta.; 20 hank dou. rov.,	**26c.**	**24½c.**		**=**	**50½c.**

COST.

1,008 ends, 60/1 American combed..........+ 4% take-up = .0208 @ 44c.	=	$ .0092
608 ends, 60/2 American combed..........+ 12% take-up = .0274 @ 48c.	=	.0132
56 picks, 90/1 American combed.......................... = .0217 @ 50½c.	=	.0110
Weaving, 145 speed, 75% production, 2 looms, $11.50 wage..........	=	.0317
Expenses, $2.50 per loom..	=	.0137
		$ .0788
Selling 2%..		.0016
Grey cost..		$ .0804
Bleaching, finishing, etc..		.0100
Finished cost..		$ .0904

Yards per pound = 14.31.
Harness to weave = 8.
Retail price, 25c. per yard.

ends are liable to be broken. The ends which are drawn in on harness No. 8 are the ones which are drawn through the loop on harness No. 1.

JACQUARD SILK WARP EOLIENNE

These cloths were quite popular about ten years ago and since then have had a regular sale, but during the past two years the number of yards sold has been largely increased and there are many new patterns and constructions being produced to-day. The better colors, and the fact that the cotton can be dyed one color and the silk another has helped increase the sales to a certain extent.

Sometimes it requires a little experimenting to get the construction what it should be for the different counts in the warp and filling. The one we are considering is a regular one, that is, 124x56 in the grey count with 40-2 combed filling. The filling used in these cloths is almost always combed yarn and also hard twisted, although in many cases it is not so hard twisted as it would be for a voile cloth.

The silk warps used in the making of these cloths vary in the different mills, being gauged in most cases by the size of yarn which they can best run, but it is practically always

ITALIAN SILK,

and runs from 20-22 to 24-26 in size in most cases. These silk warps, one would naturally think, would create some trouble in a cotton mill, but after the help becomes used to the work a warp can be started up in fully as short a time as a whole cotton warp. In the looms the work is liable to create some trouble if the heddle eyes have some sharp places, as they cut the yarn easily, and also on jacquard work, if the harness threads are worn, they are likely to catch the light silk threads and break or cut them. These cloths are made in quite large quantities with hard twist worsted filling, but, of course, cost more than the cotton filling varieties, although the worsted yarn gives them a drape which cotton never gives. Cotton yarn gives possibly a smoother cloth and shows up the silk somewhat better. These cloths are being made with silk stripes added, and because of the extra silk required, the cost is higher.

It may be asked by some the difference between these eolienne cloths and crepe cloths, as they both have silk warps and the count is somewhat similar in many cases. One difference, which does not always hold true, is that the crepe has single filling and the eolienne has two-ply filling, although they are both hard twisted. In many cases, the crepe is woven on a box loom and is called a crepe de chine, while in others it is not woven on a box loom and is called serpentine crepe, but

THE MAIN DIFFERENCE

is usually created by the finishing process, because in a crepe cloth the shrinkage may be as high as 33 per cent, while in an eolienne the cloth is finished out nearly to its grey width. This can be easily seen by looking at the two different cloths, as in a crepe the filling is all full of curves and crinkles, while in an eolienne the filling is as straight as finishing can make it without spoiling the cloth.

One thing which helps in the weaving of these cloths is that the silk used is practically always in the raw state, and does not look at all like it does when finished, but is full of gum, and this gum sticks the fibres together and keeps them from rubbing to pieces in the loom and is removed in the finishing process, and then the gloss appears on the silk threads. Care has to be given to the weaving of these cloths, because there are many things which will show when finished which on a cotton cloth would never appear. Possibly, one thing shows more than anything else and this is when a reed is a trifle bent in some places. In this way, a few ends are crowded, and then there is a small space where they are lighter, and in finishing these cloths it is very hard, almost impossible, to make these threads slide in even again

This does not make much difference in a

PIECE-DYED FABRIC

where one color is used, but where the cloth is cross-dyed it shows up this condition very plainly, because the warp shows more in one place and the filling shows plainly next to it. The cloth in hand shows this condition, while the solid colors show practically no streaks of any description.

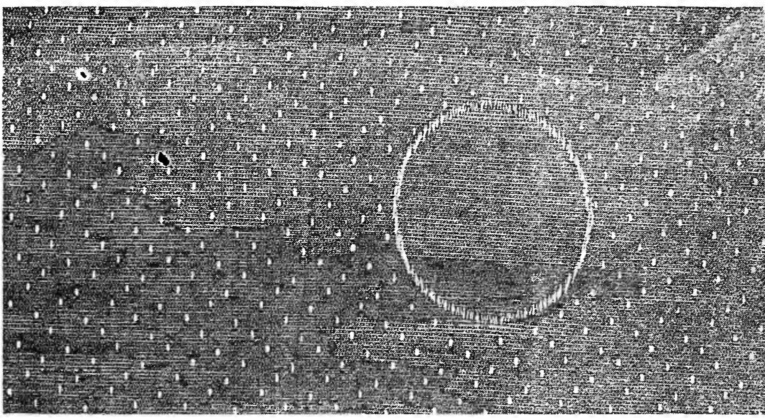
These cloths are laid out in the regular manner used for cotton jacquard work, and we will work out the cloth by successive steps. The first thing to do is to find the size of warp and filling which is used. This is easy enough in the filling, but the warp has which in this case is 126 times 53. As these cloths come in about ¾ inch in weaving and ½ inch in finishing, and as the finished width is 25½ inches, we next find the reed count and reed used.

25.5 finished width, 26.75 reed width : : X : 126 = 120 reed count.
120 ÷ 2 = 60 reed to be used.

Then we have:

60 X 26¾ reed width = 1,604 total dents.
1,604 — 44 for selvages = 1,560 cloth dents inside selvages.
1,560 X 2 = 3,120 + 176 selvages = 3,296 total ends.

The probabilities are that as long as the pattern finished is about 3 3-16 inches wide, it was 3 1-3 inches wide



Jacquard Silk Warp Eolienne.

lost quite a little because of the gum being boiled out of the silk, and it requires not only fine balances, but also a knowledge of the amount of gum in the silk, and care in the sizing of the silk, for it is very liable to split up in pulling out the threads. It also requires

A GENERAL KNOWLEDGE

of the silk sizes used by cotton mills in the making of these cloths. We find the size of the warp to be 20-22 when used and the filling about 40-2.

We next find the finished count, in the reed, as we can figure out for ourselves. From the whole layout of the cloth it appears to have been made on a 400 machine which was tied up 120 per inch in the comber board. This makes our machine laid out as follows:

400 machine ÷ 120 per inch = 3⅓ inches in 1 repeat.

It will then be seen that in this cloth the entire machine has been used, that is, ends are drawn into all the heddle eyes, and there is no cast out. This is done in most cotton mills

making these cloths, for very few mills except silk mills have machines tied up to more than 120 per inch, that is, in the ordinary cotton mills which produce shirting materials. The

NUMBER OF REPEATS

of the pattern is then found.

3,120 ends ÷ 400 = 7 repeats + 320 ends.

By referring to the following small sketch it can be seen in which sections of the tie-up the ends are used. We will consider that the width tied up is 40 inches, as this is a usual width in cotton mills. This makes 12 sections or 12 harnesses attached to one hook.

and instructions for drawing-in would be given as follows: Start to draw on hook No. 1, row No. 6, section No. 3. Finish drawing on hook No. 8, row No. 45, section No. 10. It will be noticed that 8 hooks are used in a row, as a 400 machine has usually this number of hooks placed in a row, and there are 50 rows in the machine. To lay out our pattern we will consider our cloth sketch as made, and the first thing to do is to find the paper to use. As the hooks are tied 8 in a row, the paper will be in 8 squares in the warp, and to find the filling squares we will figure thus:

126 : 53 : : 8 : X = 3⅓ or 8 X 3 paper.

.40 inches wide ÷ 3⅓ inches in 1 repeat = 12 repeats or sections.

1	2	3	4	5	6	7	8	9	10	11	12
400	400	400	400	400	400	400	400	400	400	400	400
		160–200	400	400	400	400	400	400	200–160		
		360							360		

It can thus be seen that in sections 4, 5, 6, 7, 8 and 9 there are 400 ends or all the heddles used, and that in sections No. 3 and No. 10 there are only 360 ends used. By laying the pattern out as above, it will be seen that it is exactly in the center of the tie-up and this helps in the running of

But possibly in a cloth like this it would be better to use an 8x4 paper, but in any case, with a count as high in the warp and as low in the filling, it is to a great extent

A MATTER OF EXPERIMENT

and experience to get the effects to

PATTERN.

20/22 Italian silk warp. $\frac{2}{44}$ 3,120 $\frac{2}{44}$ = 3,296 total ends.
40/2 American combed hard twist filling. 56 picks.
60 reed, 26¾" width in reed, 26" grey width, 25½" finished width. 123 X 56 grey count, 126 X 53 finished count.

YARNS.

20/22 Italian silk; 205,000 yards per pound; on beams = $4.75.

	Cotton.	Labor, waste.	Twisting.	
40/2 American combed; 1⅛" staple; 8 hank dou. rov.,	21c.	10½c.	4c.	= 35½c.

COST.

3,296 ends, 20/22 Italian silk + 8% take-up	= .0175 @ $4.75 =	$ .0831
56 picks, 40/2 American comber hard twist	= .0908 @ .35½ =	.0322
Weaving		.0159
Expenses		.0138
Jacquard cards		.0005
		$ .1455
Selling, 2%		.0029
Cost grey		$ .1484
Dyeing and finishing		.0250
Cost finished		$ .1734

Yards per pound, 9.23.
Cost at retail, 38c. per yard.

the work. The pattern to be used would be balanced up and placed on the design paper, and the layout

come out right in these cloths. There are so few picks, comparatively speaking, that the floats cannot be very

long, in any case, in the warp. It is to be noticed that on the small slots a pick of filling is allowed to float on the top and bottom of the spot to make the figure rounder and to hold down the warp better. This is a general practice on these cloths with small ground spots, as it makes a more even looking cloth and figure. To get the number of squares in the height of the design, it is better where the picks are as low as in this cloth, to find the height of the pattern and multiply by the picks per inch, and

THIS RESULT

should be divided by the picks in a square, and in this way, a more accurate result is obtained in the number of squares to be used, thus:

53 picks finished × 3¾ inches = about 200 picks in a repeat.
200 ÷ 3 = 66 squares about, or if 8 × 4 paper.

was used we would have

200 ÷ 4 = 50 squares in the filling.

In the warp we would have

400 ÷ 8 = 50 squares in the warp.

To find the weight of the warp and filling and from these the yards per pound, and then the cost, is a rather simple proceeding. The yards per pound in the silk warp will vary, but we have taken a low enough number of yards to be on the safe side in figuring. To obtain the output of the warp, we figure as follows:

3,296 ends ÷ 205,000 yards = .0160, weight of warp without take-up.
.0160 ÷ .92 = .0175, weight of warp in 1 yard of cloth.

We have used 8 per cent for take-up in weaving.

The weight of the filling is obtained thus:

$$\frac{56 \text{ picks} \times 26\tfrac{3}{4}'' \text{ reed width} \times 36''}{36} = 1{,}498$$

yards of filling.
1,498 ÷ 16,500 = .0908, weight of filling in 1 yard of cloth.

We have used this number of yards for 40-2, because in twisting it contracts somewhat.

.0175 + .0908 = .1083, weight of 1 yard of cloth.
1.0000 ÷ .1083 = 9.23 yards per pound.

The cloth is lighter than this when sold for

THREE REASONS:

First, because of finishing and ironing the yarns are somewhat finer, although this makes only a small difference in weight; second, because the silk loses the largest share of the gum it contained in finishing; third, because in finishing the cloth is stretched about 5 per cent, and this not only makes less picks per inch, but stretches out some of the take-up of the warp in weaving.

FAST COLOR SOIESETTE SHIRTING

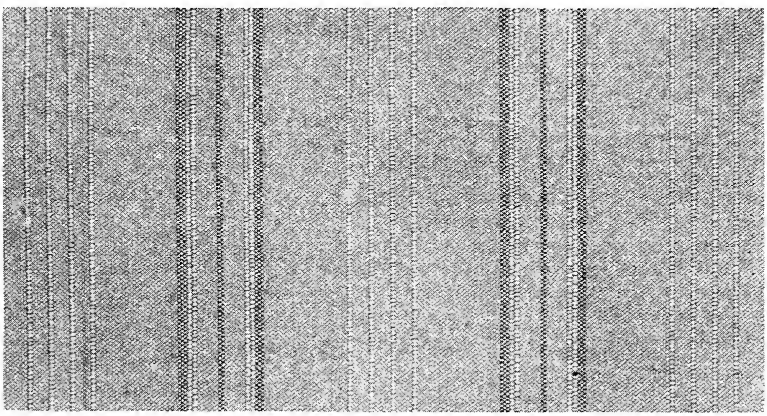
The name soiesette is copyrighted and is used by Clarence Whitman & Company on the line of cloths which is produced by them. These cloths are made in varied styles and constructions and have had a large sale. It must not be thought that the cloths produced by this concern are the only ones which can be bought in these lines, for many mills make similar fabrics which have had a large sale, and although the name soiesette cannot be used by others, the constructions and ideas can and are. Buyers ask for a soiesette construction and all they really mean is that it is a soft twist filling fabric with a construction such that it will take mercerization well. The name soiesette has lost to a certain extent its connection with fabrics produced by any certain house, and the trade in general uses the name when speaking of a certain

CLOTH CONSTRUCTION

and not the production of any one certain house. Thus, the ideas have been absorbed for the good of the trade. In our analysis we find the warp which was used was 85-1 and the filling was 43-1. We have used Egyptian cotton for filling, but it is also possible to use American.

The cloth we are considering is a

fair example of the many lines of shirtings which are being sold at present. It is to be noted that even though the price of this cloth is 30 cents in the stores, many shirts are being sold with cloth of this quality at about $1.50, and these shirts are better than have been sold previously. The quality of men's shirtings and ladies' waistings has improved very much during the past five years, this improvement being due in a great measure to the improvements in finishing cloth, and also to the dyeing of yarn and cloth which is also showing large improvement. The quality of yarn entering of the warp and soft twist grey or unbleached filling, and when the cloth is woven it is bleached which, of course, makes the grey yarn white, but does not affect the dyed yarn, and then it is mercerized which gives the filling a sheen which makes the cloth more desirable. It can be seen that by using grey soft twist filling a better mercerized finish will result, because in the mercerizing process a soft twist yarn mercerizes better and, of course, grey yarn which is not handled can be used softer twisted than bleached yarn. The process of mercerizing cloth consists of immersion



Fast Color Soiesette Shirting.

into cloth is to-day better than ever, and this may be due partly to the larger competition in these lines of fabrics and also to the fact that even yarn makes a large difference in the finish of a piece of goods as finished to-day. Possibly the fact that in most all colored lines where dyed and bleached yarn was used the cloth did not take a mercerized finish because of harder twist in the filling to facilitate handling, made the cloth somewhat less desirable than at present. The fact is that yarn can be dyed fast colors which will stand bleaching, and that then a cloth can be made up as a regular colored shirting using grey or unbleached yarn for the rest in caustic soda and at the same time keeping the tension as much as possible on the filling or cloth width. If the tension was not much, the cloth when passed into the liquid would shrink and there would be no luster, and the reason the tension is placed on the filling in this particular instance is because the filling is made soft twisted, and this takes the finish better than the warp. In some lines of fabrics the tension is placed on the warp, especially such cloths as mercerized poplins. The reason this is done is because the warp is made of two-ply soft twist yarn. Almost all cloths which are mercerized are mercerized in the filling, because there are

comparatively few cloths on which two-ply soft twist warp is used, while there are many fabrics which have medium or soft twist filling.

ONE FEATURE

which appears in this cloth is not noticeable with other colors of dyed yarn. With an ordinary magnifying glass may be seen what are called black hairs, which project off the black, fast-colored yarn. In many cases this black yarn has made much trouble for the mills in cloth rejections, for in some cases the cloth will be full of these hairs alongside the black yarn, although in this cloth the amount of these hairs is about as small as possible. For the above reason, mills have been forced to use as good black yarn as is possible in this class of fabric, and in many cases it has been necessary to use fine two-ply yarn wherever a black color was used. It has been a practice to use black combed yarn for stripes in carded colored yarn shirtings, for these black hairs, which, of course, are more prominent in carded yarn, would in many cases spoil the fabric. With medium dark colors this effect is not noticeable, although these hairs are present, but because of their fineness and because they do not so strongly contrast with the white ground, they are not noticeable to any extent, and certainly not enough to hurt the general appearance of the cloth in most cases.

One thing which hurts the wearing qualities of most all shirtings is the presence of hard cords in the pattern. When the cloth is ironed there is a tendency to cut the filling, and this soon makes the cloth split on the cords and so renders a shirt useless before it is actually worn anywhere. We do not think the above will make any difference in the amount of shirtings with cords which are made, and we hope it will not, because it is a case where the beauty of a pattern is much better with the addition of a few cords even if the wearing qualities are lessened to a certain extent. Shirtings in many cases would not be made in attractive patterns if it were not for the

TOUCH OF VARIETY

which is added by the addition of a few cords. Nearly the same effect is produced by very narrow satin stripes and the wearing qualities of a shirting with satin stripes for cords is largely improved.

It is to be noticed in most all soiesette cloths that the warp is usually of fine yarn, relatively speaking, in comparison with the filling, also that the count is somewhat lower in the warp than in the filling. These above facts are brought about in the construction of the cloth so that the finish will be better when mercerized, and another fact which helps in this direction is soft twist in the filling, and in many cases, the use of Egyptian cotton which possibly takes mercerization somewhat better than many grades of American cotton.

The grey counts on some of these cloths are as follows: 64 times 72 with 50-1 warp and 30-1 filling, 68 times 84 with 50-1 warp and 35-1 filling, 72 times 96 with 60-1 or 70-1 warp and 40-1 filling, and there are many variations from these constructions both in yarn and count, but the warp is almost always made of fine yarn, and the filling of coarser

SOFT TWIST FILLING.

In weaving cloths such as we are considering it is necessary that care be exercised by the fixers or else the take-up on the lighter beams is liable to be large, and this will make an entirely different looking fabric, and in some cases, spoil the effect. The above is not so likely to happen if single yarn is used, but when two-ply is used, much more care is necessary as the stiffness of the yarn is liable to help make loops and a large take-up, thereby making a bad looking fabric in many cases. Cloth has been noticed in the stores where this effect has approached a regular seersucker effect, and then when more tension has been applied, the defect has entirely disappeared in the cloth.

THE EXPENSE

of making these cloths is rather high.

because of the fact that, having a high number of picks, the production is rather slow, and this makes the weaving and other charges greater. The cost of finishing this sort of fabric is not large, as it has only to be bleached when woven and then mercerized, and it is much easier and cheaper to bleach and mercerize cloth than it is to handle yarn in the same manner.

If the filling is made well on these cloths, the result is likely to appear well, as the flling covers up to a certain extent the warp yarn, although a warp as fine as the one we are considering has to be good yarn to stand the beating up of so many picks.

These cloths are about 32 inches wide finished, and as they shrink about 2 inches in finishing and 1¾ to 2 inches in weaving, we have from the finished counts of 72 in the warp the following:

32 : 35.75 : : X : 72 = about 64.
64 ÷ 2 = 32 reed to be used.
32 X 35¾ = 1,144 total dents.
1,144 — 16 selvages = 1,128 dents inside selvages.

By comparison we find the cords are reeded 1 in a dent, while all the other yarn is reeded 2 in a dent, and then by laying out our pattern we find that there are 60 dents in a repeat of the pattern, so we have:

1,128 ÷ 60 = 18 repeats + 48 dents over.

In balancing up this pattern we find that with 48 dents over we will have one cord next the selvage on one side and none on the other, so to make the two edges exact we will use only 47 dents over and then the pattern will balance as we have laid out in our

COST ANALYSIS.

The picks in the finished cloth average about 92, and so there were probably 96 in the grey cloth.

The yarn is drawn in on four harnesses in regular order just as if it were for an ordinary plain white warp, but when the warp is reeded in the cords are drawn 1 in a dent, while the other yarn is reeded 2 in a dent. The sizes of the yarns are found in the usual manner, and we then proceed to find the weight of the cloth.

1,870 ends ÷ (840 X 85) = .0262, weight of 85/1 warp without take-up.
.0262 ÷ .92 = .0295, weight of 85/1 warp

PATTERN.

	2																						2	
85/1 Am. c'mb'd	16	31			8		8			31		6		31			8		8			31	16	= 1,870
30/1 Am. c'mb'd black			3			2			3						3			2			3			= 152
16/2 Am. c'mb'd				2				2			1		1			2				2				= 148
											3 X													2,170
		18 X																						

96 picks, 43/1 English combed soft twist filling. 32 reed, 35¾" width in reed; 34" grey width, 32" finished width; 68 X 96 grey count ground; 72 X 92 finished count ground.

YARNS.

		Cotton.	Labor, waste.		
85/1 Am. combed; 1½" sta.;	17 hank dou. rov.,	28c.	27c.		= 55c.
30/1 Am. combed b'k; 1⅛" sta.;	6 hank dou. rov.,	21c.	9c.	Dyeing 8c.	= 38c.
16/2 Am. combed; 1$\frac{1}{16}$" sta.;	3.25 hank dou. rov.,	17½c.	5½c.	Twisting 2c.	= 26c.
43/1 Eng. combed; 1¼" sta.;	10.5 hank dou. rov.,	26c.	13c.		= 39c.

COST.

1,870 ends, 85/1 Am. combed................+	8% take-up	= .0295 @ 55c.	=	$ .0162
152 ends, 30/1 Am. combed................+	10% take-up	= .0067 @ 38c.	=	.0026
148 ends, 16/2 Am. combed................+	2% take-up	= .0224 @ 26c.	=	.0058
96 picks, 43/1 Eng. combed..............................		= .0950 @ 39c.	=	.0371
Weaving				.0154
Expenses				.0201
				$ .0972
Selling				.0020
				$ .0992
Bleaching, mercerizing, etc..................................				.0150
				$ .1142

Yards per pound, 6.51.
Plain weave.
Retail price, 30c. per yard.

with take-up.
152 ends ÷ (840 × 30) = .0060, weight of 30/1 warp without take-up.
0060 ÷ .9 = .0067, weight of 30/1 warp with take-up.
148 ends ÷ (840 × 8) = .0220, weight of 16/2 warp without take-up.
.0220 ÷ .98 = .0224, weight of 16/2 warp with take-up.

$$\frac{96 \times 35\frac{3}{4} \times 36}{36} = 3{,}432 \text{ yards of filling in 1 yard of cloth.}$$

3,432 ÷ (840 × 43) = .0950, weight of filling in 1 yard of cloth.
.0295 + .0067 + .0224 + .0950 = .1536, weight of 1 yard of cloth.
1.0000 ÷ .1536 = 6.51 yards per pound.

These fabrics look well as long as they will hold together, for the fibre has undergone a change, and the nice glossy appearance will not wash out as in some fabrics, but

THE WEARING VALUE

of these cloths does not compare with a well mercerized two-ply warp poplin, although, of course, both cloths have individual uses where the other cannot be used. The weaving cost is rather high on these cloths, because of the high number of picks. This cloth, as made in most cases, has 104 picks in the grey, but the piece we have analyzed has only 92 picks finished, so the grey count probably was not over 96. If this cloth was made with 104 picks, the cost would be about ½c. extra from the price we have figured, that is, the extra 8 picks would add about ¼c. in yarn and the weaving and expenses would add about ¼c. per yard.

Mercerization makes the cotton fibre, which is a flat twisted tube, swell up and become rather round, and takes out of the fibre the crinkle so that it is like a small glass rod. This gives the fibre its luster. In mercerizing cloth by some methods

CARE HAS TO BE EXERCISED

or the cloth is likely to split because of the tension caused in the process; especially is this true of the lighter cloths which are mercerized. Cloth with soft twist filling, of course, is not likely to wear as well as if the filling were harder twisted, but what is sacrificed in wearing qualities is more than made up in the improved looks of the cloth because of the mercerizing process. Large profits have been realized from the sale of these cloths, as there was a good profit per yard, and the yards produced have been larger than in many other lines of fancy cloth.

BOX LOOM DOTTED SWISS

These varieties of fabrics are made and sold in large volume, and the sale seems to be more regular than on many other lines. Cloths of this description are used for many purposes, such as waists and dresses, curtains and also for printing purposes. The goods are made in many qualities, but as a usual thing, the ground cloth is rather fine, as cloths go, and the count is not as close as in some other lines of fabrics, although the ground cloth is hardly ever loose enough to slip except on the very cheap fabrics.

The spots are usually in the shape of small polka dots spaced in a drop pattern order, the spaces between the spots being regulated to a certain extent by the size of the spots; that is, for a small spot a small space is allowed between, while with a larger spot a larger space is allowed. These spots are made with the use of extra yarn, and the box loom is used for weaving the pattern, sometimes a pick and pick loom is used, as in the cloth we are considering, while at other instances a box loom is used which can throw no less than two picks of each kind of filling. Patterns are not only made with spots as noted, but in many cases

FANCY FIGURES

are made and jacquard looms are used in their production. Spots are also made by using extra warp yarn, and then an ordinary loom is used which has no box attachment. These cloths are not as good as the ones made with extra filling, because it is impossible to get as much yarn into the spot, and this has a tendency to make the extra warp spots look light, but the price of extra warp spots is less because there are less picks per inch, and this allows a larger production and reduces the price. Spots are also made with the lappet motion which are sometimes sold in the same class with

the spots made, as above described but they are in most cases not as good as filling-made spots, although the ground cloth is usually similar in weight and count. The price of these cloths is usually less than either of the above.

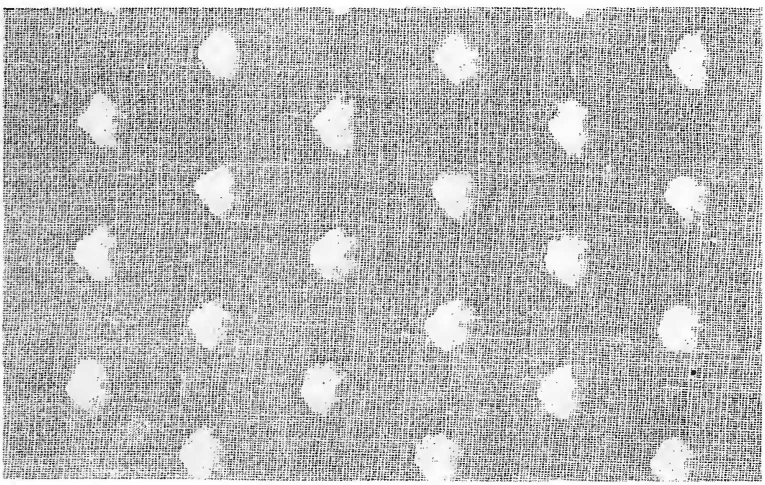
Possibly, the greatest trouble experienced in the making of these cloths is found in the fact that, when the extra warp or filling is being placed in the cloth, there is very likely to be a streak in the cloth where there are fewer picks than there ought to be. This is due to the fact that the ground cloth is rather light and the heavier filling or warp yarn when placed in the cloth holds out the filling from beating up, thus making thin and thick places. This holds true in all kinds of cloth of this nature, and many times it is absolutely impossible to eradicate all of the trouble, especially when a very light ground is used with a heavy spot.

In making this kind of cloth with extra filling it is necessary to weave

THE CLOTH FACE DOWN

to get good results. A reason can be seen for this, which is as follows: If woven face up, it would be necessary when the spot is being made to lift about three-quarters of the total warp yarn, and this would make a bad streak, because it makes a heavier lift for the loom than when making the plain part of the pattern. With the face woven down, this trouble is not present to any extent. When the spot or extra filling is being placed in the cloth, the take-up pawl is raised, and this makes the ground cloth have the same number of picks throughout the pattern.

It can be noticed in this cloth that the extra filling is not woven into the selvage. Many mills persist in making these cloths with filling woven into the selvage, thereby spoiling, in some cases, what otherwise would be a good looking piece of cloth. It is unnecessary to have this condition, as a wire or cord will obviate the necessity of holding the filling which makes the spot.



Box Loom Dotted Swiss.

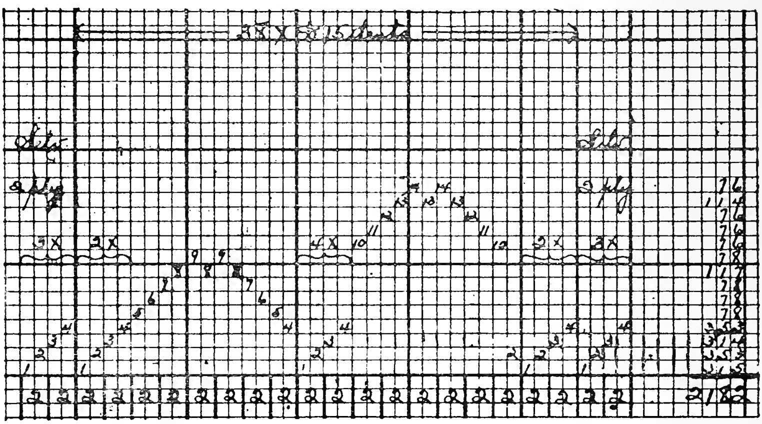
One large advantage in the use of extra filling is that when the cloth is to be sheared the knives on the shearer will pick up the extra filling much easier than extra warp, thereby making a much better piece of work. Because of this same reason, it is possible to make spots closer together

with extra filling, and it is hardly ever necessary to bind in the filling, while in many cases extra warp yarn has to be bound in above and below the spot, so as to hold it tight enough to be sheared without pulling out. This is one thing which is often noticed on cloth made with extra warp, and throughout the patterns or spots, there is likely to be extra warp threads missing which

THE SHEARING PROCESS

has pulled out. Sometimes this cannot be helped, as it is impossible to bind in the extra yarn satisfactorily without spoiling the looks of the figure. The cloth is first run through a machine which cuts the long floats, but does not clip them close, as is noticed in the cloth. This is done in a following process, where the long, loose threads are brushed up and clipped down close. In the first process, care must be exercised or the machine is likely to clip holes in the cloth, thereby spoiling it for use. Sometimes only one machine is used, and the cloth is given a number of runs so the ends can be cut down close.

On many of these fabrics the waste produced is quite an item, as the amount of cloth sold is large. On the cloth we are considering, about 1 pound of waste is made on every 25 yards of cloth. If this waste can be used in some cheaper yarn, or if it can be sold to advantage, it sometimes



means quite a saving on the cost of the cloth to the manufacturer.

There is no question but that in the majority of cases the cloths made on the pick and pick looms are much better than patterns made with the ordinary box loom, and the prices of these cloths are higher than those made by other methods. The above statement holds true possibly in very few cases, but it is a fact with the kind of cloth we are considering.

ONE ADVANTAGE

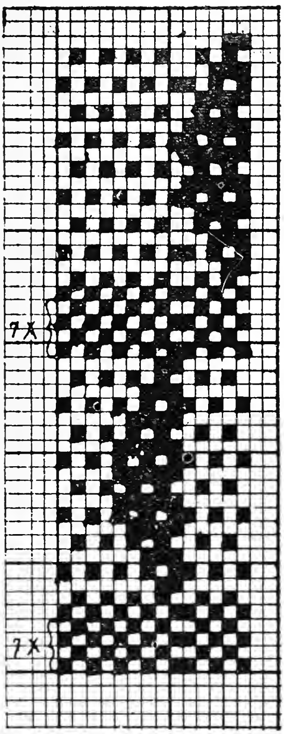
of using extra filling in making these cloths is that a spot will be softer and look better than if extra warp were used. This is because warp yarn is twisted harder than filling and does not spread out so well and make a nice full spot.

Many of the cheaper cloths are made from carded yarns and sell as low as 5 cents per yard at the mills. The cost of cloth made with filling is higher, because the speed of the looms is much lower and the picks per inch total are higher. This makes the yards produced smaller, and, therefore, increases the cost.

Spots similar to the ones we are considering are sometimes made on an embroidery loom. This, of course, makes a much better result, and the price is usually much higher. Cloths made on these looms are entirely different from the results obtained either by box loom or lappet motion. In fact,

the ordinary cloths such as we are analyzing are usually copies of spots or effects which have been made on an embroidered cloth.

The effects usually produced on dobby looms are similar to the one we have analyzed, although, as we stated previously, there are many effects made on jacquard and embroidery looms. In most all cases on the simple



patterns it is not a question of complex designing but one of

TROUBLESOME WEAVING

which makes poor looking cloth. A man who lays out patterns for cloths such as these ought to study constructions very carefully, for it is possible many times to run a sample piece with care so that the cloth is practically even and has no thick and thin places, but when this cloth is ordered and looms are put on weaving the cloth, it is nearly impossible to get good results. Much trouble is likely to be caused in this manner unless care is exercised when the cloth is first laid out. This is a very broad subject and one which is coming more and more to the front, for it is beginning to be realized by men in the trade that orders are placed in many cases on cloth which should not be woven, because the construction used was not what it should be for the cloth being made. Sometimes the count is too low and the goods will slip and cause cancellations, and in other cases, a too close count will be used to produce the best results. This can be seen in some cases on voile cloths being sold, for on some of these the count is too close, and not only is it a waste of material, but a poorer effect is produced than if a somewhat lower count were used. These facts show that there is a need of closer study of cloth construction by buyers, because the making of fancy cloths is broadening out very rapidly, and there is little knowledge on the subject which can be obtained which applies in these particular instances.

WEIGHTS OF YARNS.

To get the weights of the various yarns used and the yards per pound we figure as follows:

2,206 ends ÷ (840 × 55) = .0477, weight without take-up.

.0477 ÷ .95 = .0502, weight with take-up.

$\frac{64 \times 20\frac{1}{2} \times 36}{36}$ = 1,888 yards 65/1 filling in 1 yard of cloth.

1,888 ÷ (65 × 840) = .0346, weight of 65/1 filling.

$\frac{15.16 \times 29\frac{1}{2} \times 36}{36}$ = 447.17 yards 10/1 filling in 1 yard of cloth.

447.17 ÷ (840 × 10) = .0532, weight of 10/1 filling.

.0502 + .0346 + .0532 = .1380, total weight.

1.0000 ÷ .1380 = 7.25 yards per pound before shearing.

These fabrics are almost always made of grey yarn, and are bleached when woven and sheared. When sold to the converter they are sold sheared, and he has them finished, dyed or printed, as the trade demands. However, in most cases, they are finished white. Fabrics with bunches of material printed on have taken some of the

places where these fabrics have been used, but there is a large and increasing demand for cloth of this description.

PATTERN.

	2		2		
55/1 American combed warp.	12	2,158	12	=	2,206 ends.
65/1 American combed filling			64		picks.
10/1 American carded filling			15.16		picks.
			79.16		picks total.

37 reed; 29½" reed width; 27½" finished width; 27½" grey width; finished count, 80 × 61 ground; 80 × 76 over all. Grey count, 80 × 64 ground; 80 × 79.16 over all.

YARNS.

		Cotton.	Labor & waste.		
55/1 American combed; 1 5-16" sta.;	11 hank dou. rov.,	25c.	16c.	=	41c.
65/1 American combed; 1¼" sta.;	16 hank dou. rov.,	24c.	17½c.	=	41½c.
10/1 American carded; 1" sta.;	2.5 hank dou. rov.,	14c.	4c.	=	18c.

COST.

2,206 ends, 55/1 American combed + 5% take-up	= .0502 @ 41c.	=	$ .0206
64 picks 65/1 American combed	= .0346 @ 41½c.	=	.0144
15.16 picks, 10/1 American carded	= .0532 @ 18c.	=	.0096
Weaving			.0168
Expenses			.0220
			$ .0834
Shearing			.0025
			$ .0859
Selling			.0017
Cost grey			$ .0876
Bleaching, finishing, etc			.0125
Cost finished			$ .1001

Yards per pound = 7.25 before shearing.
Yards per pound = 9.75 about finished.
Price at retail, 25c.

ARTIFICIAL SILK STRIPE VOILE

The cloth we are considering is one of a variety which is being sold in quite large quantities at present and is likely to sell in larger quantities the coming summer. It is made of much finer yarn than is usually sold, but it is a well-made fabric with even yarn, and is representative of the finer expensive class of cotton voiles.

The construction used is about what it should be for the size of yarn used. This question of cloth construction is one which has been considered but lightly by many buyers, for in many cases, constructions are ordered which are not suitable. Many times constr ctions are bought which are too low, and of course, it can be imagined that these were bought to get them as low in price as possible, but in other cases, a too high count has been ordered. Quite a number of instances have come to notice where on voile cloths a lower count could have been used and not only a better price secured, but a better looking fabric would have resulted. It is a fact that in many cases even the cotton used in a cloth will, to a certain amount, regulate the count to be used, for a rough cotton will require a lower count than a smooth cotton to produce as firm a texture.

WITH MANY SELLERS

it is a practice to make cloths of as low count as possible and not have them slip badly when handled. This policy is a good one for some grades of cloth, such as voiles, but for many other fabrics it is a bad practice to adopt, for sometimes cloth quality is regulated by its fineness and firmness and other times by its sheer look or openness. To put all fabrics on the same basis would be a foolish step, but this is about what some buyers or sellers would like to do. Of course, it is well known that many cloths are ordered with low counts through ig-

norance in many cases, for it has been impossible to obtain men who understood cloth construction well enough to direct the buying. This condition is just beginning to be realized, because of the large increase in fancy woven fabrics, and to understand conditions well, it is almost necessary that some technical training be had as a foundation, and it is also necessary that quite a little actual mill experience be obtained to give any sort of reliable estimates or information on the many grades of fabrics being bought and used to-day. It is to be noticed that there is quite a little artificial silk used in the pattern. This silk has been used but little in the weaving of cloth in America, but has been made into braids, ties and like articles.

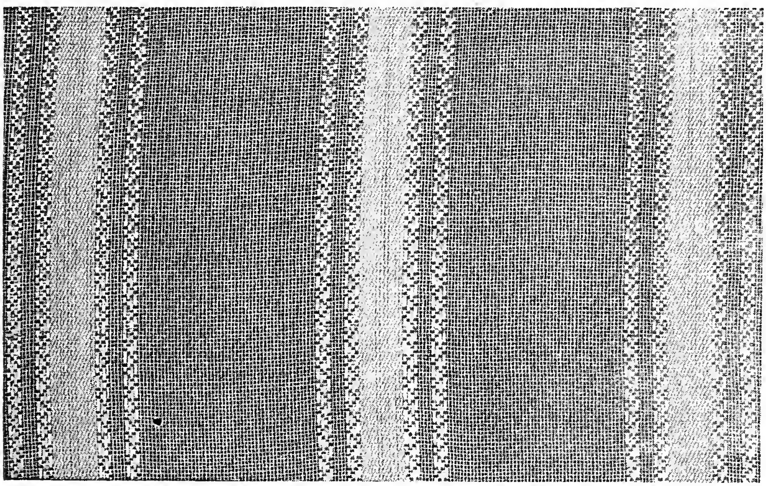
THE REASON

for this has been its high cost, comparatively speaking, for the cost has not been, as many supposed, very much lower than real silk because the threads are heavier and what has been in many cases saved in the lower price has been made up by the fact that not so many yards of cloth could be obtained per pound as when using real silk. The price on this artificial silk has been reduced lately and the quality improved so that its use is likely to increase, especially in such cloths as voiles and low count fancy cloths. The reason why more of this silk has not been woven, regardless of the price, is because in any but a coarse cloth the rubbing of the reed in weaving has split up the fibres in the thread, thereby making it weak and causing very bad weaving yarn. The yarn is strong if no rubbing is applied which splits the threads, although the newer yarn is much better than that formerly sold. Of course, all buyers have been familiar with the fact that by wetting the yarn the strength was lost. This fact has also

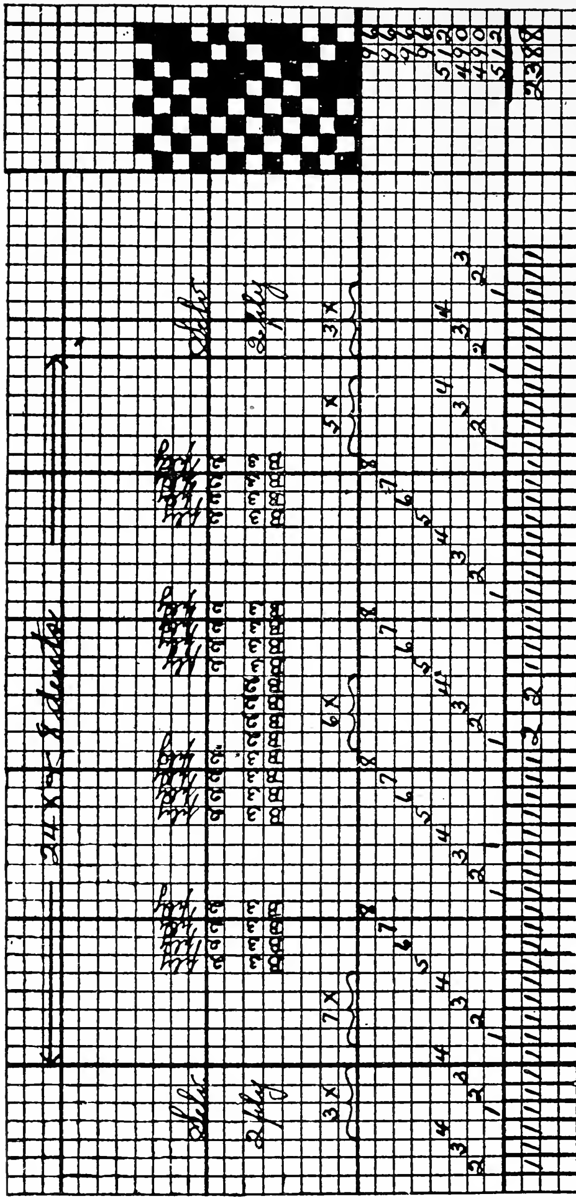
RETARDED ITS USE,

although by using this silk for stripes where the strain comes on the ground yarn, there seems to be no serious objection to a large increase in use.

In bleaching, the silk is liable to lose a part of its high luster, unless especial care is exercised, although, in the case in hand, which is a bleached and piece-dyed fabric, the silk seems to look as well as before processing. One thing which has helped in the



Artificial Silk Stripe Voile.



Draft and Chain for Artificial Silk Stripe Voile.

weaving of this yarn is the use of it in the grey state before being bleached, as this prevents part of the bad splitting usually noticed.

These voile fabrics which are being made and sold to-day in large quantities are most of them made of hard twist two-ply yarn. Some cloth has been made and sold in which single hard-twist yarn was used, but the quantity made in fancy cloths has been small and the quality has not compared with the two-ply article. The hard twist two-ply is made on a twisting frame, or, in some cases on a spinning frame. The reason the yarn is hard twisted is because by this method a smooth, round thread is produced. In making this yarn sometimes trouble is caused by the yarn cutting the travelers, and as it is hard twisted, it will kink up and break down more ends. If a spinning frame is used, quite a number of processes are saved in the making of filling, for with the use of enamelled bobbins the yarn when twisted and steamed is ready for the loom. This, of course, is

QUITE A SAVING

in the cost to make, besides a smaller amount of machinery is required.

The standard of twist used in this yarn varies in different mills and for different qualities of cloth. In usual cases the standard is from 6.50 to 8, but the main point is to have the yarn as smooth and round as possible. To obtain this result, yarn is sometimes run through a gas flame, which burrs off a large share of the fibres which project.

Cloth such as we are considering is usually sold by a converter rather than a jobber. These cloths are in many cases sold direct to the retailer and the prices and profits obtained are much larger than in many coarser fabrics. It is to be noticed that in the heavy stripe where 60-2 yarn is used the cloth approaches the effect produced in the class of fabrics known as poplins, and on which the count is in many cases about 100x48. These fabrics are used in many cases for overdresses, and the quality produced compares very favorably with the worsted cloths made for the same purpose, when the

DIFFERENCE IN PRICE

is considered. Possibly, each has a large place to fill in the production of desirable fabrics. The finished count in the warp is about 54, so under these conditions, a 50-reed was probably used, and as these cloths shrink in weaving and finishing from two to three inches. depending on the yarn size and construction used, we will find the layout of the pattern as follows:

50 reed × 42 inches = 2,100 total dents.
2,100 — 28 selvages = 2,072 dents inside selvages.

By comparing the different parts of the pattern we find that the 60-2 yarn is reeded two ends in a dent, the 100-2 one end in a dent, and the artificial silk one end in a dent drawn two-ply. This gives the total number of dents in the pattern as 86. The only way to tell how these or any yarns are reeded when a cloth is finished is by careful observation, and can only be learned through years of experience in the making up of cloth. and actual experience in a mill, and even under these conditions, it is rather hard to tell because cloth is pulled a lot in the finishing operations.

2,072 ÷ 86 = 24 repeats + 8 dents.

To balance up our patterns so that the stripes will be the same distance from the selvage, we add the dents left over (8) to the dents in the plain part of pattern (50) and divide by 2:

50 + 8 = 58 ÷ 2 = 29.

This gives us 29 dents of plain or voile weave to follow when the selvage is drawn, and it can be seen from the layout of the pattern on our cost estimate that the cloth exactly balances, as it starts and ends with 29 dents of plain. Patterns should always be balanced, if possible, for it makes a much better looking piece of goods on the counters and helps much in the selling.

To get

THE DIFFERENT WEIGHTS

of yarn used in one yard of cloth, and from these weights to get the yards of cloth per pound, we proceed as follows:

1,456 ends ÷ 38,500 = .0378, weight of 100/2 warp without take-up.
.0378 ÷ .95 = .0398, weight of 100/2 in 1 yard of cloth.
576 ends ÷ (60/2 × 840) = .0228, weight of 60/2 warp without take-up.
.0228 ÷ .93 = .0245, weight of 60/2 in 1 yard of cloth.
768 ends ÷ 30,000 = .0256, weight of 150 denier warp without take-up.
.0256 ÷ .96 = .0267, weight of 150 denier in 1 yard of cloth.

$$\frac{52 \text{ picks} \times 42'' \times 36}{36} = 2{,}184 \text{ yards of filling in 1 yard of cloth.}$$

2,184 ÷ 38,500 = .0567, weight of 100/2 filling in 1 yard of cloth.
.0398 + .0245 + .0267 + .0567 = .1477, total weight of 1 yard of cloth.
1.0000 ÷ .1477 = 6.77 yards per pound.

It is to be noticed that 38,500 yards are used for figuring weights instead of 42,000 yards, which is the standard usually taken for 100-2. The reason this is done is because in the twisting operation, when hard twist is made, the yarn contracts to a certain extent, and this yardage allows for this contraction. The yardage taken for the artificial silk, namely 30,000, is what it actually runs when sized, and not the theoretical yardage, for this will be found to be somewhat over 29,500. In finishing, the cloth is held out, because the hard twist yarn will make the cloth crepe up unless this is done.

PATTERN.

100/2 Sea Island hard twist	$\frac{2}{14}$	29		4				4		21	8	$\frac{2}{14}$	=	1,456
60/2 American combed						24							=	576
150 denier artificial silk			$\frac{2}{4}$		$\frac{2}{4}$		$\frac{2}{4}$		$\frac{2}{4}$				=	768
		24 ×												2,800

52 picks, 100/2 Sea Island hard twist.
50 reed, 42" width in reed, 40" finished width, 70 × 50 finished count over all.

YARNS.

	Cotton.	Labor. waste, etc.		
100/2 Sea Island hard twist; 1¾" sta.; 20 hank dou. rov.,	30c.	48c.	=	$ .78
60/2 Am. combed; 1⅜" sta.; 12 hank dou. rov.,	26c.	21c.	=	.47
150 denier artificial silk; 30,000 yds. per lb. Price on spools, $2.50 + 10c. beaming			=	2.60
100/2 Sea Island hard twist filling; same as warp,			=	.78

COST.

1,456 ends, 100/2 Sea Island hard twist	+ 5% take-up	= .0398	@ $ .78	=	$ .0310
576 ends, 60/2 American combed	+ 7% take-up	= .0245	@ .47	=	.0115
768 ends, 150 denier artificial silk	+ 4% take-up	= .0267	@ 2.60	=	.0694
56 picks, 100/2 Sea Island hard twist		= .0567	@ .78	=	.0442
Weaving					.0147
Expenses					.0128
					$ .1836
Selling					.0037
Grey cost					$ .1873
Bleaching, dyeing and finishing					.0300
Finished cost					$ .2173

Yards per pound, 6.77.
Cost at retail, 69 cents.

FINE YARN STRIPE

The cloth we have analyzed is one of many which can be obtained in most stores. The weight varies to quite an extent on these cloths, as different cloth constructions and stripe spacings are used, and the yarns may be of many different sizes, but the cloths are all light, because fine yarns are almost always used in manufacturing. Some lines of fabrics are finished white, and probably most of these cloths reach the consumer in this condition, but many times printed patterns are used, and sometimes the cloth is dyed solid colors. Many cases have been noticed where the cloth quality was poor and where the converter, to cover up the effect produced by uneven yarn, would have patterns printed which more or less eliminated this defect.

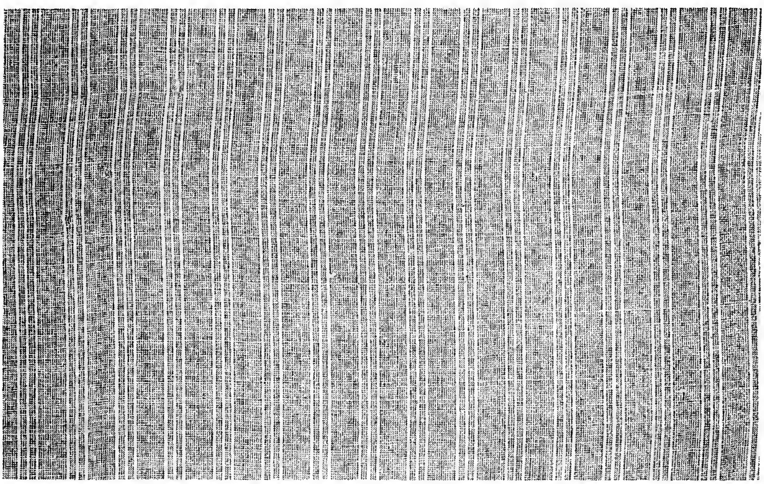
The beauty of these fabrics lies in the evenness and the sheer effect produced. Of course, as it is realized that figures which are woven on such a cloth do not appear well, plain weave is invariably used in weaving, and in

the yarns used the result will largely depend. This means that not only must good staple cotton be used to make the fine yarn required, but care must be exercised in the different processes of yarn making. The cost of a yarn will vary possibly more in fine numbers than in coarse, because even though high-priced cotton is used, the material cost is small, as compared with the labor cost, whereas in coarse yarn the material constitutes the large item of expense. The staple of cotton used in a certain size of yarn will vary, and this affects the cost, but the economy of management where large saving is made in the labor expense will more largely affect the yarn price.

To obtain the best price for the cloth produced, or the highest profit, requires a good deal of judgment, for it is sometimes possible to make a poor quality of yarn from short staple cotton, comparatively speaking, and by pushing production to the limit, and even if the cloth quality is not as good as it might be, to sometimes obtain a larger profit than if a better article were made. To obtain the best production in yarn and in weaving, it is necessary to use good cotton, for what can be saved in cotton cost is more than lost by the difference in yarn and weaving cost.

Patterns which are made in constructions similar to our sample are limited in comparison with goods made on fancy looms, and the large production is confined to plain cloth, checks and stripes in various counts and yarn sizes. These fabrics are sold largely to converters, who have them finished and then distribute them in their regular channels. Printing establishments have bought and used large quantities of cloths, which they finish and print in various patterns. The amounts of cloth which are bought are larger than in other fancy or fine construction lines. This does not mean that more total goods are sold, but that where a buyer takes 100 pieces of fancy cloth he is likely to buy 1,000 pieces of a fine construction cloth. In this way, the individual orders to a mill are larger and the costs of production less in comparison. Possibly, fewer converters handle such lines than they do fancy cloth.

It might be a good thing to say that to-day the prices on most lines of fine cloths are much lower than in the past, for the price of cotton used in these cloths will not be much lower, and



Fine Yarn Stripe.

competition has been keener than for some time. Prices are much lower in comparison on fine goods than on the coarser lines to-day. This results from the fact that prices on coarser lines have not been readjusted to the lower price of short staple cotton. They have been lowered somewhat but not as much as they will be under conditions as they are at present. It is a fact that the margin of profit on print cloth is larger to-day than many believe, for only five times in the past twenty-five years has the margin been yard, but this price varies with the quality and width. Fabrics are made on high-speed looms of light construction, and few mills have been built to make such cloths except in quite large units. This, of course, cuts down many expenses which would make it hard for a small mill to compete for business. In many mills warp yarn is made on a spinning frame, while the fine filling is spun on mules. It is a fact that with the use of longer staple cottons not as large a standard of twist is necessary to produce as

PATTERN.

80/1 Sea Island combed.............. $\frac{2}{12}\ \underbrace{6\ \frac{4}{1}\ 2\ \frac{4}{1}\ 2\ \frac{4}{1}\ 6}_{108\ \times}\ \frac{2}{12}$ = 3,072 total ends.

165/1 Sea Island combed; 88 picks.
40 reed, 30" width in reed, 28" finished width; 109 × 88 finished count over all; 86 × 88 finished ground count.

YARNS.

	Cotton.	Labor, waste.		
80/1 Sea Island combed, 1½" staple, 16 hank dou. rov.,	30c.	26c.	=	56c.
165/1 Sea Island combed, 1⅝" staple, 30 hank dou. rov.,	32c.	46c.	=	78c.

COST.

3,072 ends, 80/1 Sea Island + 4%..................= .0475 @ 56c.	=	$ .0266
88 picks, 165/1 Sea Island..................= .0191 @ 78c.	=	.0149
Weaving		.0068
Expenses		.0087
		$ .0570
Selling		.0012
Grey cost		$ .0582
Finishing, etc.		.0150
Finished cost		$ .0732

Yards per pound, 15.01.
Plain weave.
Retail price, 25c.

more than at the present time. Buyers would do well to consider the future, for we do not believe there will be a much better time to obtain favorable prices on fine goods than at present, and we do not blame buyers for holding off purchases on coarse goods, for it looks as if better prices could be obtained later. The only thing which has kept up coarse cloth prices has been the small quantity of goods on hand, and it is likely prices will fail as mills of this sort begin to operate. Buyers usually figure prices on a pound basis on fine cloths, and to show what some of these cost, we will say that the price on

INDIA LINONS,

which weigh about the same as this cloth, is in the vicinity of 80 cents per pound, or over 5 cents per good results as in coarser sizes of yarn, and with many manufacturers too high a standard has been used on many yarns to obtain the highest break. Manufacturers have been too busy in many cases to make enough extended experiments to show them that a slightly stronger yarn could be produced with less twist than has sometimes been used and so they would govern themselves by someone else's ideas rather than by facts. We have in our analysis placed all the warp yarn on one beam. This may or may not have been the case in making the cloth, for sometimes small cords can be woven from

THE SAME BEAM

as the ground, and in other cases they require an extra beam. Some mills weave satin stripes from a ground

beam, while others never have much success in this method. The quality of the yarn used and the reeding of the yarn sometimes determines how many beams to use, for take-ups have to be somewhat similar to make good weaving warps.

To find the weight of the warp and filling used, and from these weights to obtain the yards per pound, is a rather simple proceeding:

3,072 ends ÷ (80 × 840) = .0457, weight of warp without take-up.
.0457 ÷ .96 = .0475, weight of warp with take-up.

The weaving take-up as used is about 4 per cent.

$\frac{88 \text{ picks} \times 30'' \times 36''}{36''}$ = 2,640 yds. of filling in 1 yard of cloth.
2,640 ÷ (840 × 165) = .0191, weight of filling.
.0475 + .0191 = .0666, total weight per yard.
1.0000 ÷ .0666 = 15.01 yards per pound.

Many of the imported fabrics have decorations in embroidery, and for this reason, these fabrics cost more than the plain cloths. Possibly, the larger share of domestic manufactures are made so that they sell at a price below 25 cents per yard.

In marked contrast to some of the costs of manufacture, the price of material, including waste on this cost, only amounts to about 43 per cent, while the remainder, which constitutes the larger share, is made up of labor, repairs, insurance, depreciation and the various items of cost. Very few of the ordinary cloths are made in which the material, including waste, does not exceed the other items of expense. A very small profit per yard, in comparison with that which the retailer obtains, is sufficient to make a good return upon the capital invested, and it is probable that 1 cent per yard is as much as a mill would average to receive in profits on many fabrics similar to sample.

JACQUARD SHIRTINGS

The fabric we have analyzed is one on which very many patterns are produced and which is sold from year to year in more or less regularity. Different patterns are made up to suit the various demands of fashion, but the cloth construction and width do not vary to any large degree. The cloth is made of carded yarn and on a jacquard loom and is made to sell in place of finer combed yarn cloths, which have about the same construction. It is a fact that some of these carded fabrics are mercerized and make serviceable and good materials in many ways. In our cost we have allowed good staple cotton for making the yarn, as it is true that these yarns are more often made of shorter cotton. In our different items of expense, we have given figures which are known facts, and the results secured are rather interesting, in that the cloth is being sold more or less at present. Prices of material and other expenses do not vary largely in today's basis from those obtaining when the cloth was sold. This fabric was sold or offered for sale by Seth Borden and was made in either the Hargraves or Parker mills, probably in the latter-mentioned plant.

The original price at the beginning of the season was 12½ cents, but before the season was through, the price had declined to 10½ cents. It is probable that the larger amount of cloth was sold at the first price. In considering the manufacturing price on our cost, no attention need be paid to the finishing charges, as these cloths are usually sold to converters in the grey state and they pay all finishing charges, so the grey cloth cost and manufacturer's price represent the profits secured by the mill which made the cloth.

In our estimate, the total

COST OF MAKING

this fabric is about 8 1-7 cents per yard. Allowing that 10½ cents was the price of the cloth to a converter, it is evident that a profit of over 2 cents per yard is obtained, or exactly 2.35 cents. At this profit per yard a loom will earn about $3.50 per week or about $182 per year. In a mill of 1,000 looms, if this same rate of profit be secured, the total profit would be about $182,000. In the capitalization, the amount given is $800,000, so the profit secured would be somewhat

over 22 per cent if all cloths were sold under the same ratio of profit. What the profit would be if 12½ cents, the highest price, were used can easily be seen, as it would give an earning per yard per loom of $286, or about a profit of 35 per cent if $800,000 were used as the total amount invested.

This fabric was evidently made on a 400-jacquard loom and has three repeats of the pattern in the width of the machine. It is tied up 100 per inch, giving a width in the comber board of four inches and a grey cloth width of about three and three-quarters inches and slightly less than this width when finished. Looms which make fabrics similar to sample have double the number of hooks in the jacquard head, but they are tied up so that two hooks operate one eye, and in this machine, which could weave 400 ends in a pattern, there would be 800 hooks in the machine head. The reason for tying up in this manner is that a much higher loom speed can be obtained, and a fair estimate would give a speed of about 145 to 150 picks per minute. Some looms are operated faster than this, but it is questionable whether results warrant higher speeds than this or not.

In making patterns like sample it is necessary to have

THE INDIVIDUAL FIGURES

grouped so that no open spaces appear between figures in either warp or filling direction. If this is not done bad streaks are likely to result in the woven cloth. It is always a good plan to make figures overlap slightly, thus eliminating much of this trouble. Figures are practically always made of filling floats, though warp floats are sometimes used to bring up special effects. The reason why filling floats are used largely is that this yarn is of softer twist than the warp, covering up and making a smoother and better effect, and when mercerized, the process usually gives the luster to the filling yarn, for the cloth is held in tension in the cloth width direction.

The usual method in selling fabrics similar to sample is to quote a price for the cloth construction, and when an order is placed, the buyer will pick out patterns which he thinks may be suitable for his trade. Sometimes much confusion is made by a buyer deciding to change his patterns when cloth making is in process, and many times friction is made between buyers and sellers for this reason. Many methods are used in making similar cloths salable, for they are bleached and mercerized like sample, they are piece-dyed in various colors, and are bleached and printed with various patterns and colors. A large outlet is thus made possible in these lines, but probably most of the cloth is sold in the white condition, the woven pattern constituting the only effect in the finished cloth. It is certain that most of the cloth for the coming summer will be bleached and mercerized only and not dyed or printed in fabrics of this character, so woven figures will constitute the effects produced.

LARGE ORDERS OBTAINED.

Contrary to the belief of many, it can be said that sometimes large orders are obtained on fabrics of this kind. It is true that the number of pieces per pattern may be comparatively small, but the number of yards woven with a certain cloth construction may be large. The only difference which obtains between orders on some of the coarser lines, and on lines similar to sample, is that designs must be changed more often on fancy cloth. This is not so large an undertaking nor so expensive as many believe, for making designs for simple filling float figures is a comparatively quick operation, as is the cutting of cards for the loom. The cost of jacquard cards may seem a rather large item, but when figured down to the cost per yard which is produced, the amount is very small, as can be seen from our analysis of costs.

In making up the details for placing the design upon point paper and in the instructions regarding the drawing-in operation, the foundation is obtained in analyzing the cloth. As we have given in the cost estimate, the reed used was probably No. 40 and the jacquard head, a regular 400, which was tied up, 100 per inch in the comber board, giving a width of four

inches, then we have 40 reed times four inches equals 160 dents in total pattern or machine repeat. 160 dents times 2 ends per dent equals 320 ends in total pattern or machine repeat.

As there are three repeats of the pattern in the total pattern or machine repeat, it can be seen that 320 will not be exactly the number of ends to have the repeats come right, that is, the total ends must be either 318 or 324. The facts are that in a pattern similar to the sample analyzed, 320 ends would probably be used and one of the figure repeats be moved over two ends, making the figures take up 106, 106 and 108 ends, respectively, giving a total of 320. This change never would be noted on a pattern of this kind.

Considering that the jacquard machine is made to weave 40-inch cloth, we would have 40 inches divided by 4 inches, one repeat, equals 10 sections in the tie-up. As we have figured that the warp has 2,420 ends inside the selvages and there are 320 ends used in one section, we can find the sections used and in this way balance the cloth in the loom.

2,420 ÷ 320 = 7 sections + 180 ends.

If we refer to the small diagram it will be seen plainly in which sections the ends are drawn. The lower half represents the total tie-up while the upper half represents the ends which are used.

From the diagram given it can be seen that the warp is balanced in the loom, thereby making better work. Instructions for drawing-in would be as follows:

Start drawing warp on hook No. 7, row No. 9, section No. 2.

Finishing drawing warp on hook No. 2, row No. 39, section No. 9.

If a pattern should be used in which stripes or cords were present, the pattern itself would be balanced in a method similar to regular dobby work, and if a pattern was balanced and called for 50 ends of plain to start, these 50 ends would start on the point-paper on the 7th hook or end in row 9, as above noted. This arrangement gives accurate results and the best looking and running cloth. In very many instances, jacquard patterns are never balanced, detracting much from the looks of the woven cloth and also its selling ability. Many times, it is impossible to make patterns balance, for designers do not always plan the layout in the loom. Patterns have to be sometimes repainted for this very reason.

In making patterns some buyers do not understand why some cloths with identical constructions do not appear as firm as others. They order patterns with varying sizes of figures and others with ground weaves, and because some patterns slip, they think

1	2	3	4	5	6	7	8	9	10
	90 160	320	320	320	320	320	320	160 90	
400	400	400	400	400	400	400	400	400	400

As 400 machines are tied up 8 hooks in a row, it can be seen that there are 50 rows total. If only 320 ends or hooks are used, there will be 400 less 320 equals 80 hooks to cast out.

80 ÷ 8 in a row = 10 rows or 5 rows in each half section cast out.

Possibly the best way to cast out these rows would be to cast out rows 11, 12, 23, 24, 25, 36, 37, 48, 49, 50. This splits up the total cast out and makes better running work than if the total amount was cast out in one place.

mills are cutting down on cloth construction or yarns, when the facts are that the less interweaving there is in cloth, due to longer floats on ground weaves, the more a cloth will slip, and the more nearly the weave approaches the plain weave the firmer will be the result. More care on the part of some buyers will eliminate a part of the friction which sometimes appears between buyers and sellers regarding the cloth produced. Two different weaves may produce entirely different results even if the cloth construction be identical.

PATTERN.

	2		2	
40/1 Am. carded warp.	20	2,240	20	= 2,500, total ends.

28/1 American carded filling. 72 picks.
40 reed, 30¾" width in reed, 29" grey width, 28" finished width; 85 × 72 grey count; 88 × 68 finished count.

YARN.

	Cotton.	Labor, waste.	
40/1 Am. carded; 1¼" staple; 8 hank dou. rov.,	21c.	9c.	= 30c.
28/1 Am. carded; 1¼" staple; 6.5 hank dou. rov.,	21c.	7c.	= 28c.

COST.

2,500 ends, 40/1 Am. carded + 8% take-up = .0809 @ 30c.	= $ .0243
72 picks, 28/1 Am. carded = .0941 @ 28c.	= .0264
Weaving	.0122
Expenses	.0166
Jacquard cards	.0004
	$ .0799
Selling	.0016
Grey, or mill cost	$ .0815
Bleaching and finishing	.0125
Finished cost	$ .0940

Yards per pound, 5.71.
Mill selling price, 12½c., reduced later to 10½c. per yard.

SILK MIXTURE LENO SCARFING

Fabrics of various constructions and materials have been used in the past in quite large quantities for scarfings and similar purposes. Many of them have been made of silk and net, and as a general thing, they are light in weight and rather expensive to the consumer, because of their method of manufacture. There has been a large sale of such fabrics during the past year, and it is expected that the amount of cloth sold will increase in the future. One reason for the increase in sales is the lower price at which many new lines are being sold. The reason for this is the making of novelties in silk and cotton by many northern mills. These silk and cotton cloths, of which the sample we have analyzed is one, are not such good fabrics as many whole silk articles, but they look very well indeed, and, of course, the appearance is what sells many fabrics, so it has resulted in many new lines being produced. One thing which is very noticeable is that the patterns produced are more novel and better than have ever been produced in silk at anywhere near comparative prices. This is a general condition, as it will be found that when conditions are created whereby

NOVELTY COTTON

manufacturers can make certain kinds of fabrics at a profit, many newer combinations and effects will be produced than have ever before been seen. More ingenuity is possibly required in cotton novelty making than is necessary in any other line of endeavor, for not only are a large amount of patterns required, but a large number of constructions also. More ideas have possibly been produced in scarfings since articles were manufactured of cotton and silk than were seen before. Another instance of cotton novelty cloth progress is seen in the ideas produced in fancy cotton voiles. Voiles were made in worsted, and sold before any were hardly attempted in cotton, but it is safe to say that to-day the ideas produced in cotton are far more novel and beautiful than the majority of worsted lines; that is, as far as cotton looms are able to produce and the limit of price will warrant with cotton as a ground work. Many lessons might be learned from cotton manufacturers to-day by others, and from appearances it would help in straightening out some of the vexing problems which are present.

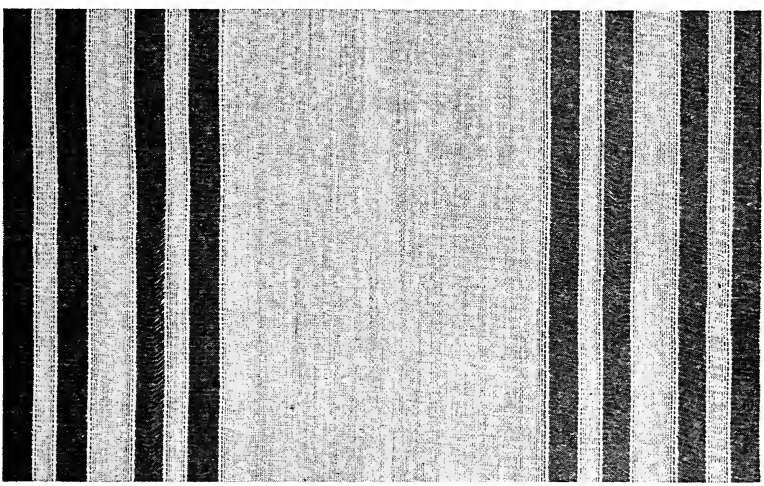
One other thing which many people

do not realize is that to-day there is quite a little competition on the silk and cotton, and also on the other fancy lines of cloth. Because the retail prices are high does not signify that the mills have obtained exorbitant prices in many cases, for there are few lines which to-day are being offered by mills which have more value, everything considered, than many of the fancy novelty cloths. The facts are that the prices are made closer than is believed. This does not mean that no profit is made, or that prices do not vary, but it does mean that

MARGINS ARE CLOSE

in most cases. When the price of silk varies 15 per cent, or more, sometimes, in a short time, it is necessary to vary prices, but the mills receive little benefit unless gambling is resorted to, and, of course, this is not the way to run a mill, as some have found out. It is a fact that many cotton manufacturers are more accurate and systematic in keeping track of their costs than in other lines. Possibly, this is because larger plants are the rule, in the North, at least, in cotton lines, and necessity compels more care in prices, but it is a fact that, taken as a whole, few cotton manufacturers are able to give accurate costs on fabrics, except where only a few grades of cloth are made, and then they cannot give detailed figures. In woolen lines, it is true that a very large improvement could be made, for in many cases, prices are not made which compare with the costs of production.

The cloth we are considering is a simple weave. The stripes are plain, and on each edge is a leno weave which holds each stripe in place, and keeps the openwork as clear as possible. The leno weave changes every second pick, because with a change of every pick, the weave would be too close, and would cut the light filling.



Silk Mixture Leno Scarfing.

Even with the construction used, the fabric slips somewhat, due to the large amount of openwork used. The cloth has only 140 doups, and it is probable a weaver could run four looms, for the cloth is narrow, and the filling runs well. If a weaver could run but two looms, the increase in weaving cost would be somewhat over two cents, so the saving here represents a large amount. Weavers have run four

looms successfully on much harder cloth to weave than this, so our

ESTIMATE IS REASONABLE.

These cloths are practically always woven in the grey, and then finished and dyed. Fast colors to stand bleaching are being used to a certain extent to produce desired results. Many fabrics in fancy weaves, with the same construction as is used in this scarfing, have been sold at less than 11½ cents in the grey state for 27 inches wide. These fabrics are retailing for 25 cents per yard. Considering the price at which mills have sold these fabrics, it is safe to say that very few lines in woolen cloths are produced on so narrow a margin of profit. Cotton manufacturers have been giving better cloth at closer prices than is generally believed, but it is a fact that consumers have benefited very little, even if makers have reduced prices, and are supplying better cloth, too. What mills need to-day is a large demand, so that orders can be procured to keep their looms in operation, for, with full production, the prices received would, in the majority of cases, be satisfactory. High prices to the consumer seem to restrict a large sale, and manufacturers are suffering in a large measure for conditions which they have had nothing to do with; in fact, the prices quoted by manufacturers to-day, on fancy and fine goods, should mean a large demand, but unfortunately, it has not.

Fabrics made from silk and cotton are handled in increasing quantity by regular silk houses which convert them and sell to the retailers, and which, in many cases, conduct their business similar to converting jobbers, and, of course, receive converting jobbers' profits. This cloth was made when silk was cheaper than at present, so the figured cost, which represents to-day's basis, may have been made lower, because of a lower material charge. The total warp cost is only about 1½ cents, so it shows how accurate figures must be to even be fairly reliable.

Nearly all fabrics which have openwork stripes, and in which silk or any slippery yarn is used, have leno ends woven on the openwork edges, to keep the stripes in place, for they are likely to slip badly in use. Heavy yarn, if used for leno ends, is likely to cut the fine silk filling. In many of the silk fabrics which are composed of part cotton, it is a fact that the silk used will vary surprisingly, not only in the yards per pound in the same lot of silk, but some manufacturers will make a pattern and use a finer silk to produce it so as to compete with other more expensive yarn. Of course, a good manufacturer makes a contract and usually states the quality of yarn to be used, which

ELIMINATES ALL TROUBLE

of such nature, but it cannot eliminate the variation in size to which the yarn is subject. Where the practice is used is when buyers have ordered a certain pattern with a certain silk and then when the cloth appears to be selling well, to place more orders with a finer silk, and make no change in price, and many buyers think they are obtaining the same cloth, which they are not. Buyers have insisted that they were protecting themselves, lest others offer cloths of lower count, or of finer silk, to sell at a lower price, but many times, it was not done for this purpose, and we do not believe buyers have known the quality received, for it is sometimes hard for an expert to tell what size silk has been used, especially if the cloth has been worked much to spread out the fibres. The only way to ascertain, in such cases, is with a large magnifying glass, which few have, and besides cloth is not bought by jobbers or retailers in this manner. Mills deliver the quality of cloth called for, and the substitution is done after the mill has delivered the goods. Buyers know quite a little in regard to cloth construction in fancy cotton lines, but knowledge should not be used in a wrong manner.

It is a good thing to have buyers in cotton understand something of cloth construction, as it results in better cloth from the mills, and it would be a good thing for many woolen buyers to obtain some knowledge of cloth, for they are sadly lacking in this re-

spect. Large retailers should also check up their deliveries from converters. The large retailers who are doing converting seem destined to solve many of the problems which confront buyers and consumers today. They are at least getting large returns from the knowledge of cloth which they are applying to their systems of distribution, and they usually get the quality of cloth they desire, and are not likely to change the construction. The silk yardage we have used in figuring our weights is not the theoretical yardage for this size silk but it is an assumed yardage arrived at from actual tests, which will protect the manufacturer when the silk yardage varies, as has been previously stated.

INSTRUCTIONS FOR DYEING.

This sample is dyed a solid color on both the cotton and silk. It is of a pale blue shade, and can be very conveniently obtained, with direct cotton colors so selected that the dyestuff will work equally well on both fibres. The following formula is recommended for dyeing this color: 1-10 per cent diamine blue, R. W. (Cassella Color Company.)

This amount of color is to be taken on the weight of material to be dyed and added to the dye-bath, which should also contain three ounces of soap, one ounce of soda and four ounces of Glauber's salt to each 10 gallons of the dye-liquid.

This material is dyed in the piece, and most conveniently in the ordinary dye-kettle, used for piece-dyeing. The water employed for the preparation of the dye-bath should be as soft as possible, in order to preserve the brilliancy of the silk, and to obtain the true pure tone of the color. When all of the ingredients, together with the dyestuff, have been added to the bath, the liquor should be brought to the temperature of 140 degrees Fahrenheit, and the goods run for one hour at that temperature. After the dyeing has been completed, the goods should be rinsed off in soft water, or if this is not available, a little soda should be added to the water in order to correct its hardness.

In order to increase the brilliancy of the silk after dyeing, the goods may be run through a diluted bath of acetic acid, containing about two ounces of acetic acid to 10 gallons of

PATTERN.

																											Ends.
60/1 Am. cmb. wp.	2/16	8		20		8		168		8		20		8		20		8		168		8		20		8	2/16	=1,000
60/2 Am. cmb. wp.			4		4		4		4		4		4		4		4		4		4		4		4			= 280
		4×											53×												4×			Total 1,280

14/16 2 thread Canton silk filling; 76 picks.
46 reed, 25¾" width in reed, 24" grey width, 24" finished width; 99 × 76 ground count; 53 × 76 over all count.

YARNS.

	Cotton.	Labor, waste.	Twisting.	
60/2 Am. comb. warp; 1⅜" sta.; 12 hank dou. rov.,	26c.	17c.	4c.	= $ .47
60/1 Am. comb. warp; 1⅜" sta.; 12 hank dou. rov.,	26c.	17c.		= .43
14/16 2 thread Canton silk; 135,000 yds. per lb.; ready on quills				= 3.55

COST.

1,000 ends, 60/1 Am. combed	+ 4% take-up	= .0206	@ $ .43	= $ .0089
280 ends, 60/2 Am. combed	+ 15% take-up	= .0131	@ .47	= .0062
76 picks, 14/16 2 thread Canton silk		= .0145	@ 3.55	= .0515
Weaving				.0215
Expenses				.0187
				$ .1068
Selling				.0021
Cost grey				$ .1089
Finishing, dyeing, etc.				.0300
Cost finished				$ .1389

Yards per pound, 20.75.
Retail price, 27c.

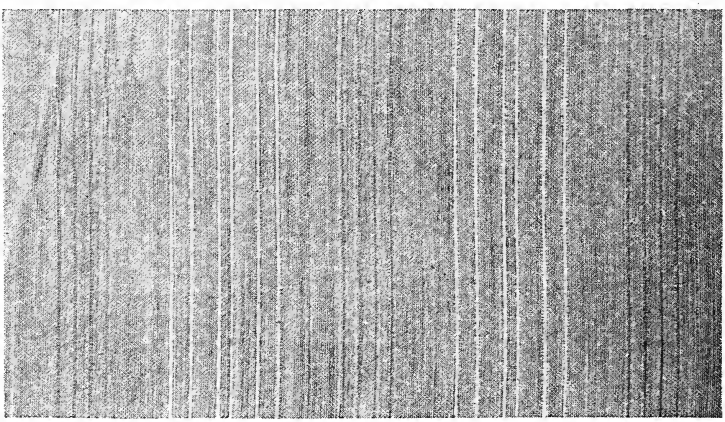
liquor, and dried without rinsing. After the brightening has been completed, the goods should be run over a spreader for the purpose of straightening out the goods and then dried over ordinary drying cans without too much tension being put on the fabric.

SILK MIXTURE FAST COLOR NOVELTIES

In our analysis of these fabrics we have given the patterns of both cloths, but the cost applies only to the blue sample. The yarns are identical in the samples, but the reed width in the blue striped cloth is 38¼ inches, while the reed width of the heliotrope fabric is 38 inches. It will be found that the cost of producing different patterns will vary little, as will be explained later.

These cloths are some of the newest ideas in manufacturing, for not only are they novelties, inasmuch as they contain silk, but they also contain yarn which is dyed before weaving and which has been bleached when woven. It is only within a short time that such colors have been used, and it is certain that the future holds large opportunities in these lines. Many mills use colors which are called fast, and they are to an extent fast, but they will not stand a bleaching process, while the colors used in these samples are practically as bright as before the bleaching process. There are samples of cloth made that contain silk yarn which when bleached are still fast and bright, but they have not been sold to as large an extent as they will be later, when the results can be seen.

What the above facts mean is little appreciated by many in the trade, for they have not felt the effects as yet, but sooner or later it will be hard for certain mills to obtain orders. This will be brought about by the fact that many lines of cloth can be made cheaper and possibly better by this method. The past summer has seen the beginning, in a large way, of certain changes which are bound to follow. It is a fact that men are not wearing shirtings with large amounts of color in them as formerly, and it is true that fabrics, generally, of this character are better looking if quite a little white is used in their make-up. For this reason, it can be seen that cloth can be produced cheaper by using a small number of fast-colored ends and bleaching the cloth when woven, for it is much easier and cheaper to bleach



Heliotrope Shirting.

cloth than it is yarn. Not only is it cheaper, but it is also possible to use soft twist yarn for filling, and this allows the cloth to be mercerized in the piece, which adds much to the appearance when sold. Because more twist is needed so that yarns can be handled satisfactorily when they are used in a yarn-dyed fabric, mercerization adds but little to the looks of a fabric, so this process is seldom used.

The use of yarn of this character places almost any grey cloth mill in a position to make many varieties of cloths which it otherwise could not produce, and makes the amount of cloth sold by purely shirting mills much smaller. Not only do the above facts stand out clearly, but it is also true that grey fabric mills are able to produce, generally, cloths of large variety in regard to sizes of yarn used. Shirting mills have only a few qualities of fabrics, that is, their yarn sizes do not vary much, and their patterns are produced by different colors and cords in various spacings and combinations, while in a grey mill it is the weave and yarn size, together with the cloth construction used, which give the result. It can thus be seen that

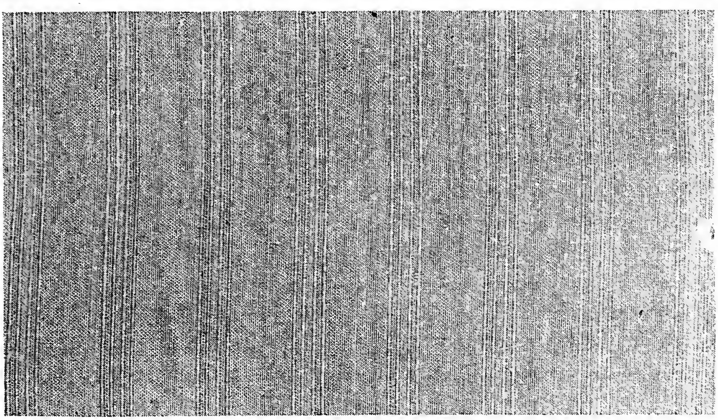
MUCH FINER CLOTH,

regarding yarn and count, can be produced in a grey yarn mill.

Take the cloth analyzed and it will be seen that the ground warp is 60-1. Few colored shirting mills use yarn much finer than 40-1, and most use 30-1 in their shirtings, while 60-1 is only a medium size in a grey mill which makes fancy and fine cloths. In fabrics, color and cords are used for decorative purposes, and it can be seen that, although the color is 30-1, the cloth effect is given by the 60-1 used.

Many fine shirtings will be produced soon which cannot be approached by a regular shirting mill and which will displace more or less fabrics made by the older type of mills. Even at present the older mills have had to develop other lines of colored novelties to keep their looms in operation, and their sales are continually growing smaller. This fact is seen from the statement that the large shirt manufacturers are buying cloth in increasing amounts from grey mills and then having the cloth finished at a regular finishing plant, whereas formerly, in some cases, they bought a large share of the product of shirting mills.

Many instances of the above are becoming known, and it is certain that shirt makers are obtaining their cloth cheaper than ever, or if not cheaper, then they are receiving better quality



Blue Shirting.

for the same price, when cloth selling conditions are considered.

Some of these older mills are rather skeptical regarding the cloth selling prices in these lines, and claim cloths cannot be made for the prices at which they are sold, but the fact remains that the cloths are sold, and mills making them declare good dividends. Mills making cloths of this nature have no dyehouses and usually have the yarn dyed at a dyeing plant. Of course, this costs somewhat more than if done at one's own plant, but it saves the outlay for a dyehouse, and as the amounts used are not large, the added cost is small, as far as the cost of producing goes.

Regarding the two cloths analyzed, it can be stated that they are made for various purposes, and are a distinct improvement on some of the past fabrics. They will be used to quite an extent for shirtings for men. Some may say that this will affect the sale of regular cloths but little, yet it is believed that the wear will be satisfactory, and it is very likely that they will displace some of the all-cotton fabrics. Cloth will not cost a shirt maker over 75 cents per shirt, and this should make the retail price reasonable to many men. It will be seen that the largest item in producing is the cost of the silk. This is almost 12 cents per yard or over one-half the total cost.

In some fabrics a lighter silk is used, which reduces the cost somewhat, but, naturally, this silk does not wear as well. It is to be noted that there is quite a large number of picks. When fabrics were first made of cotton and silk, the above count was used in the make-up, but the picks were gradually reduced to 96, and then lower, so that at present much of the plain warp variety is made in a count of 96 by 76. When these fabrics were first produced,

THE RETAIL PRICE

was about 50 cents for a cloth 26 inches wide.

The cloths being considered are 36 inches wide, and not only this, but they have color in the warps, and the retail price is but 45 cents. This does not mean that the retail price is what it should be, but it shows that there is much more value given than previously. In finishing, the cloth is bleached, and when it is stretched and folded, it is ready to ship. Few patterns are being sold as yet, but many are being made, and they will appear the coming spring. Not only are there stripes like the samples, but similar patterns with dobby figures, also checks in various sizes and colors, with woven figures in both dobby and jacquard ideas, and also many styles of jacquard designs. It is believed many cloths of this nature will be sold and used.

It is probably true that many fabrics for ladies' wear will not have as large a number of picks as the samples considered, and the price will be somewhat less, but it is also true that for men's shirtings a firm texture is necessary, and it is believed that if results be satisfactory, the number of picks should not be much lower than those considered. In weaving, it is necessary to keep an even tension on the colored yarn beams, for if this is not done, the smooth, even effect is lost, and the colored yarn will pucker up in the cloth, sometimes spoiling the result. No change is necessary to weave such fabrics on an ordinary loom except a shuttle to hold the silk quill as received from the throwster. Percentages of production are usually as large or larger than if cotton filling were employed, and the number of looms per weaver is as large as on fancy weaves in all-cotton cloths.

There are two sizes of cotton silk which are largely used by cotton mills, one is the regular 14-16 two-thread quality and the other is 22-26 single Canton. Both are used for the same purposes, and the 22-26 single, which is somewhat finer and also cheaper, is used to cheapen the designs produced in 14-16 two-thread, although the difference in costs is not so large as might be thought. We have used in our figures a yardage of 135,000 for 14-16 two-thread. This is not the theoretical yardage, but is a practical figure used to protect the manufacturer from variation in silk sizes. It is to be noted that finished widths in these fabrics are about as wide as the grey

widths from the looms. The shrinkage in weaving will be about two inches in ordinary cases, but the number of cords in the design is likely to affect each result somewhat.

The heavy cords are reeded one in a dent in both fabrics, while the colored and ground yarns are reeded two in a dent. The threads are all woven plain in these cloths, but the effects produced are distinctly novel. Some of the future designs which are not on the market as yet show not only novel effects produced with colored yarn and cords, but also many ingenious adaptations in the weaves used, and there should be a ready sale for much of this cloth. As the weaving operation is rather slow, orders must be placed soon or deliveries will be too late for the coming season.

PATTERN BLUE SAMPLE.

60/1 American combed	2/12	32				4				32	2/12	=	2,564
30/1 American combed blue				2				2				=	276
30/3 American carded			1		1		1		1			=	276
		69 ×											3,116

14/16 2 end Canton silk; 120 picks.

PATTERN HELIOTROPE SAMPLE.

60/1 Am. c'mb	2/12	14		6		30		8		12				12		8		16	14		6		14	2/12	= 2,808
30/1 Am. c'mb heliotrope..			3/1		3/1							4								3/1		3/1			= 380
30/3 Am. c'rd							1		1		1		1		1		1								= 138
			3 ×																	3 ×					3,326
		23 ×																							

14/16 2 end Canton silk; 120 picks.
44 reed, 38¼" width in reed, 36" grey width, 3¾" finished width; 86 × 120 grey count over all; 87 × 116 finished count over all; 93 × 120 ground count.

YARNS.

	Cotton.	Labor & waste.	Twisting.	Dyeing.		
60/1 Am. comb., 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.			=	$ .40½
30/1 Am. comb., 1⅛" sta.; 6 hank dou. rov.,	16c.	8c.		16c.	=	.40
30/3 Am. card., 1 1/16" sta.; 6 hank dou. rov.,	14c.	5½c.	4c.		=	.23½
14/16 2 end Canton silk; 135,000 yds. per lb.	On quills;				=	3.50

COST BLUE SAMPLE.

2,564 ends, 60/1 Am. combed............+ 6% take-up	= .0540	@	$ .40½	=	$ .0219
276 ends, 30/1 Am. combed blue.........+ 10% take-up	= .0122	@	.40	=	.0049
276 ends, 30/3 Am. carded..............+ 2% take-up	= .0336	@	.23½	=	.0079
120 picks, 14/16 2 end Canton silk....................	= .0340	@	3.50	=	.1190
Weaving					.0193
Expenses					.0251
					$ .1981
Selling					.0040
Mill cost					$ .2021
Bleaching, finishing, etc.					.0150
Finished cost					$ .2171

Yards per pound = 7.47.
Retail price, 45c. per yard.
Mill price, 22½c. per yard.

Dyeing Particulars.

There is only one color to be considered in this fabric, and that is a lavender shade dyed on a cotton stripe in the warp. For the dyeing of this color it is recommended to use sulphur dyestuffs, as these will stand the subsequent treatment given the fabric for the bleaching. The usual run of direct cotton dyes would not be satisfactory, for this fabric after being woven is bleached in a solution of hydrogen peroxide for the purpose of whitening both the cotton and the silk.

If direct cotton dyes were employed in this case the color would bleed to a considerable extent onto both the white cotton warp and the white silk filling. By the use of suitable sulphur dyes, however, the color can be obtained so that it will not bleed when bleached in the hydrogen peroxide bath. For the production of this lavender shade the dyeing may be carried out as follows: For 100 pounds of yarn use a bath containing 1 pound of immedial violet C and one pound of sodium sulphide crystals.

Dye for one hour at a temperature of 160 to 180 degrees Fahrenheit. While with the majority of sulphur dyes it is customary to add to the dye-bath soda ash and also a considerable quantity of either Glauber's salt or common salt, these conditions are not to be recommended in the case of dyeing with immedial violet C. It will also be noted that

THE TEMPERATURE

of the dye-bath should not be greater than 180 degrees Fahrenheit. This is for the purpose of maintaining the full brilliancy of the color. After the yarn has been dyed it should be well washed off in fresh water and then washed off in a second bath with a solution containing one ounce of soap to 10 gallons of water. This scouring bath should be employed at a temperature of 160 degrees Fahrenheit. The yarn is then hydro-extracted and dried. The fabric after weaving is given a slight bleaching with hydrogen peroxide. This is done by immersing the cloth in a solution containing 1 gallon of hydrogen peroxide (3 per cent) to 10 gallons of water. Sufficient silicate of soda is then added to this solution to insure the bath being slightly alkaline in reaction. The bleaching bath is started at a temperature of 160 degrees Fahrenheit, and the goods are left submerged therein for 8 to 10 hours, or most conveniently overnight. Sufficient heat is left on the bath during this time to keep it at a temperature of about 100 degrees Fahrenheit. After bleaching, the goods are removed and well washed in soft water.

This sample is very similar in its general make-up to the preceding sample. There is only one color to be considered and that is the light blue dyed on the stripe in the cotton warp. This color should also be dyed with the sulphur dyes so that it may stand the subsequent bleaching process with hydrogen peroxide. In order to produce this color the following procedure is recommended: For 100 pounds of yarn use a bath prepared as follows: One pound, 2 ounces, of immedial sky-blue powder, 1 pound sodium sulphide crystals and 8 ounces of soda ash.

To the above should also be added for each 10 gallons of liquor 1½ ounces of Turkey red oil and 1½ pounds of desiccated Glauber's salt. These proportions are to be taken for the first or starting bath and if subsequent lots are to be dyed it will only require about two-thirds the amount of dyestuffs and the corresponding quantity of sodium sulphide, while the amount of soda ash can be reduced to 4 ounces, Turkey red oil to 1 ounce, and the Glauber's salt to 8 ounces, the amounts of the last two ingredients being based on 10 gallons' volume of the dye-bath. The immedial sky-blue should be well dissolved by boiling up with the sodium sulphide and soda ash previous to the addition of these ingredients to the dye-bath. A prolonged boiling of the dyestuff solution, however, should be avoided, as it is liable to

CAUSE A DECOMPOSITION

of the coloring matter. The dyeing should be carried out by entering the yarn at a temperature of 85 degrees Fahrenheit, then gradually raising the temperature to about 100 degrees Fahrenheit, and continuing the dyeing for three-quarters of an hour. The yarn should then be taken out of the dye-bath, squeezed and hung up in the air for about an hour to allow for the full development of the color. It should then be given an after-treatment in a fresh bath with 2 per cent of potassium bichromate and 3 per cent of acetic acid. After this the yarn is once again well rinsed off and finally brightened in a soap bath containing 1 ounce of soap per 10 gallons of water at a temperature of 160 degrees Fahrenheit. This fabric has also been bleached in the piece with

hydrogen peroxide in a manner similar to that of the foregoing sample, the bleaching being conducted as follows:

Prepare a bath containing 1 gallon of hydrogen peroxide (3 per cent) to 10 gallons of water and add sufficient sodium silicate to make the bath distinctly alkaline in reaction. This bleaching bath is started at a temperature of 160 degrees Fahrenheit. The goods are entered and submerged beneath the liquor and left for from 8 to 10 hours or more conveniently overnight, sufficient heat being left on the bath to maintain its temperature at about 100 degrees Fahrenheit. After bleaching, the goods are removed from the bath and well washed in soft water.

CHECK FLAXON

The fabrics which are sold under this trade name are used largely at present. Styles are made in various patterns and counts, but, in general, they are all rather light cloths, although some of the fabrics would be designated as of medium weight. Many uses are found for the various lines, such as waists and dresses, and they are used for various styles of embroidery by the sellers of such cloths.

Buyers had an idea at one time that the fabrics were partly of linen, and that this was the reason for their high luster, but this notion is no longer held, for the cloths are of cotton wholly, and the finish is obtained after the cloth is woven. Most of the grades retail at twenty-five cents per yard. There is an agreement between the seller and the jobbers that no cloth will be sold to retailers over the jobbers' heads, so retailers of necessity must purchase from jobbers. There is also an understanding regarding prices, and the usual allowance is made, in order that the jobber can sell to the retailer at a price, so the latter will sell to the consumer at 25 cents per yard the grades which are supposed to be sold at this price. Few retailers are willing to depart from the prices which are named, for it is more than likely that no more cloth can be obtained if this is done. There has been and is more or less friction regarding prices, but as these cloths are highly advertised, and as they are good sellers for this reason, retailers very seldom break the prices named.

Possibly, it may not be well known, but it is a fact that on light-weight fabrics if fine yarns be used, any woven figure will not show up well when the cloth is finished unless a different process be employed than on ordinary fabrics. This statement also holds true on

STRIPES AND CHECKS

to an extent, for if any weave is employed it is hardly distinguishable unless carefully examined. There would be no object in using a weave under such conditions, so almost all fabrics with a fancy weave were formerly of medium or of rather heavy weight. This was done so that when sold the weave would show. Until the method now employed was adopted, or at least a similar process, few cloths of fine yarn had any weave in their construction except plain weave. To-day, there are many fabrics being sold with fine yarns and woven figures on which the pattern can be as distinctly seen as on some of the coarser cloths.

This result is, of course, done in the process of finishing. The fabric when sold has a gloss which brings out the woven pattern, and a crisp, harsh feel which many heavier cloths do not have. The various finishing plants do not supply information regarding the processes used in finishing, but the probabilities are that similar methods are employed in all cases. It must not be thought that the line of cloths referred to is the only one which is to-day given this finish, for it is not and many houses sell similar fabrics. It can be stated here that the finish given is purely a finish, and a large part of it will wash out when the cloth is laundered.

The process given consists of first bleaching the fabric, and when this is done, together with various preliminary processes, the fabric is given a mercerizing similar to many of the heavier cloths. This gives a small gloss to the fine yarn used, but it pro-

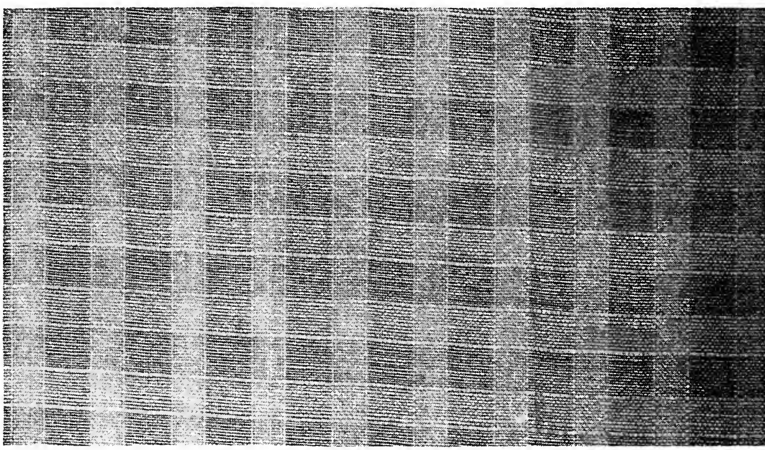
pares a foundation for the following treatment. This consists in running the cloth through a solution in which there is a transparent gum and which gives the gloss to the cloth and makes the figure stand out on the cloth. The gum also gives the crisp feel which the cloth has. No heavy calendering is used, for this would be likely to spoil the effect somewhat. From the above it can be seen that the individual threads are more or less similar to small glass rods when the process is completed.

As is well known, the beauty of any fine cloth lies in the

EVENNESS OF THE YARN

of which the fabric is woven. This is illustrated clearly by the statement that some makers of fine cloths have a hard time in obtaining market prices for their fabrics, while others can obtain somewhat more than the ruling price. The difference in price is largely explained by the difference in yarn quality. The quality of yarn being dependent somewhat on the cotton used, it will probably be true that there is not always the difference in profit which is believed when prices vary, because in the better cloth it is likely that better cotton was used, although this conclusion does not always follow. One thing which it is always necessary to do in making any kind of a fabric is to have the yarn strong enough to stand the strain of weaving. Some yarns will weave well on plain work, but will break when quite a number of harnesses are used, and for this reason, the percentage of production will be low. If a good production be obtained on plain, and a poor production on fancy patterns with the same yarn, it should be investigated and corrected if possible. Some patterns will run badly in any case because of the weave combinations used or the crowding of ends, but the highest production possible should be aimed for.

A fact which is not generally known is that yarn will run satisfactorily in a jacquard pattern which cannot be used on ordinary dobby figures. This is caused by the fact that the variation in lift from front to back harness on the jacquard is less than that on the dobby harness, and there is little strain on the yarn. A better percentage of production will be obtained at the same speed on a jacquard than on a dobby pattern if yarn and other conditions are equal. The number of looms to an operative would be identical in



Check Flaxon.

most cases on jacquard and dobby work, if the cloth woven were of similar construction. Much more care is necessary in the making of fine cloth than in the manufacture of coarse fabrics, for many times cloth which would pass as a first would be called a second in fine woven fabrics. As seconds are sold at a reduction of 5 per cent and only 5 per cent of seconds are allowed by contract, it follows that a mill which makes a larger proportion of seconds than this amount stands to lose more than their profit, because buyers do not want them, except at a large sacrifice, and if they are sold for a reduction, it will be likely to hurt the sale of the original seller, for the cloth will be offered at a lower price. This makes the identical cloth on the market for two prices, and it is needless to say that some friction is likely to result.

A great variety of patterns are produced in fine fabrics. Because of the yarn used many of the most salable styles are made by combinations of different sizes of yarns in checks and stripes. Instead of using two or more sizes of yarns it is sometimes possible to produce the same effects by crowding yarn together. Many cloths are made which have heavy woven figures, which are sheared off, and a fine ground. In many instances, the effects are produced by contrasts with heavy and light places in the woven fabric.

Yarns and cloth are

LIGHTER WHEN WOVEN

and finished than would appear if the original yarn be considered. The yarn loses weight in handling and in weaving, and the cloth is usually pulled some in finishing. Few experiments which are accurate have ever been made along these lines. Results will vary, depending on the conditions existing in both weaving and finishing. Facts are known more accurately in many of the newer fine mills than they are in some of the older colored mills. Possibly, this situation has developed from conditions existing, for in colored mills yarns are usually of few sizes, and the styling is done by color combinations, while in grey cloth where woven figures are used, weave combinations and the use of various sizes of yarns give the results.

The selling house which produced flaxon also produced soiesette. There is no doubt that the making of cloths

PATTERN.

	2		3	2	3		2		
50/1 American combed	20		1	12	1		20	=	2,390
70/1 American combed		11				9		=	1,540
		77 ×							3,930 total ends.

100/1 American combed filling; 96 picks.
38 reed; 35" width in reed; 33" grey width; 32¼" finished width; 119 × 96 grey count over all; 122 × 94 finished count over all.

YARNS.

	Cotton.	Labor & waste.		
50/1 Am. combed; 1¼" sta.; 10 hank double roving,	21c.	14¼c.	=	35¼c.
70/1 Am. combed; 1⅜" sta.; 14 hank double roving,	24c.	20½c.	=	44½c.
100/1 Am. combed; 1½" sta.; 22 hank double roving,	27c.	34½c.	=	61½c.

COST.

2,390 ends, 50/1 Am. combed	+ 4% take-up	= .0593	@ 35¼c.	=	$ .0209
1,540 ends, 70/1 Am. combed	+ 5% take-up	= .0276	@ 44½c.	=	.0123
96 picks, 100/1 Am. combed		= .0400	@ 61½c.	=	.0246
Weaving					.0144
Expenses					.0189
					$ .0911
Finishing, etc.					.0150
					$ .1061

Yards per pound, 7.88.
Retailers price, 25c. per yard.
Jobbers price, 16½c. per yard.
Commission price, 14½c. per yard.
Mill price, about 12c. per yard.

for mercerization, of which the above was possibly the leader, has added a large field to the making of fancy cloth. The sale of these constructions, with the use of fast colors and in various fancy weaves, is increasing rapidly, and is displacing many of the other lines used for similar purposes. The method of manufacture has resulted in reductions in prices which a few years ago would have seemed hardly possible. The large increase which is noted in the work done by purely finishing plants has been made possible through these new lines, because better work at a cheaper cost can be produced. Adaptation of new ideas on old cloths is an art in itself, and almost every new idea evolves others, so that the industry is bound together as a whole. The makers who first adopt such ideas are likely to receive large rewards in the way of increased business and profits, and not only this, but there is much good which always results to the trade in general through improved cloths or methods of making and finishing.

SILK MIXTURE CROSS-DYED NOVELTY

The fabric of which we have given the analysis is one which many of the newer cotton mills are to-day making in quite large quantity. These fabrics are finished in various ways, but the larger portion are dyed solid shades. Some lines of these cloths are dyed so that one kind of yarn will be one color, while the other yarn will be a different color. This gives what is called a cross-dyed effect, and the sample considered is one of these results, though in the cloth in question, the warp is dyed black, while the filling remains white. It is a fact that raw silk will in most cases give better results than if spun silk be used. The new combinations which are being made and the use of fast colors to stand bleaching on cotton and silk have added much variety to cloth production in grey cloth mills, for it is now possible to use fast colors on yarn in weaving grey cloth, and to produce some lines of three-color effects. These have not been used largely as yet, but the amount produced is likely to increase. Until recently, it was necessary to use dyed yarns for various grades of cloth which are to-day being made of grey yarns and at a reduction in the mill cost.

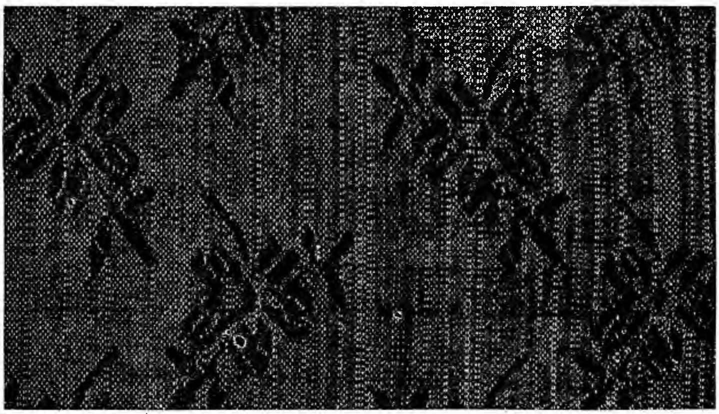
SIZES OF YARN USED.

In the making of this fabric, a number of sizes of yarns were used for the warp. These various yarns are run on one beam at the slasher. There is no pattern attempted, and they are placed in a hit or miss arrangement. Some have never been able to get satisfactory results by using various sizes of yarn from the same beam, but it is a fact that many adopt this method with good results and a decided saving in trouble. Some mills are in the habit of running different sizes of yarn in colors on the same beam, but this process requires care, especially on some patterns. The majority of cloths made in plain warps have 40-1 yarn, in fa t, this cloth is more or less standard, but each mill makes a different combination when a novelty warp is used. Some use three sizes of yarn, with 60-1, 30-1 and 30-2 mixed, while others use four grades of yarn in various sizes. Most combinations have two-ply yarn to an extent, but some like sample are made entirely of single yarn. This method makes the cost of production somewhat less. One thing which is noticed is that when novelty warps are used, the picks per inch are usually less. This is possible, because the larger sizes of yarn used tend to make the cloth firmer. Sometimes, there is a ground weave used in making up patterns for this class of cloths. What are called slash-lines are placed indiscriminately over the ground, and this process adds to the novelty of the cloth produced. To-day, there is an enormous amount of these fabrics produced, and few realize the extent to which they are used.

THE RETAIL PRICE

is at present less than half what it formerly was. It is well to make note of the fact that the cost price given is based on to-day's basis.

Not only has the Tussah silk declined much in price, but cotton is also lower, so cloth which sold last year for 14 to 14½ cents per yard is at a lower price to-day. Many buyers have cloth of this nature on hand, and they should dispose of it to retailers so that losses will not be sustained, for the new product can be sold at a reduction on former prices. It is certain that there will be a regular demand for fabrics of this general nature. Orders are for quite large quantities of cloth in comparison with some other fancy lines, but there are various patterns applied to the same livered by silk throwsters, and at other times an ordinary shuttle is used, and the filling quilled onto ordinary size cotton bobbins. In either case, the production should be as large or larger than for ordinary cotton shirtings.



Silk Mixture Cross-Dyed Novelty.

construction. It is on such a cloth as this that buyers are apt to make changes in patterns, and cause trouble at the mills when cloth is in the looms. In nearly all cases, a buyer will want sample pieces, and the making of these will eat up sometimes much of the apparent profit which a mill makes on the sale. Profits formerly were large on these cloths, but to-day a mill obtains no larger amount than for other regular lines, the margin of profit being close and the total made varying with the efficiency of operation. No difficulty is experienced in making cloths of this character on ordinary jacquard shirting looms. Sometimes a shuttle is used which will hold small quills as de-

IN ANALYZING ANY FABRIC

with various sizes of yarn it is a hard operation to obtain the number of ends and the sizes of the yarns employed in the warps. If yarn is used in stripes or in a regular pattern, the process is much simplified, but where the hit or miss system is used, exact results cannot be obtained. For this reason, manufacturers use their own combinations of yarn in duplicating other cloths.

Fabrics are usually made on either 400 or 600 jacquard looms, on which the tie-up is about 100 to 120 per inch. The width of pattern and ends per inch will vary somewhat, but the above will be true in most cases. In the cloth analyzed it was probable that the pattern was made on a 600-machine, which was tied-up 120 per inch, giving a pattern width of 5 inches. 600 divided by 120 equals 5 inches. The width of pattern in the finished cloth will depend on the amount which the cloth shrinks in weaving and also in finishing. In

many instances, this shrinkage will be from 7 to 10 per cent, although various fabrics will shrink less, and some even more, than the above amounts. It is a fact that many designers have tried to convince buyers that stripes and other variations in patterns could not be produced on regular jacquards, claiming a special tie-up was necessary, but it will be found on investigation that a very large percentage of such patterns are produced on regular tie-ups. It would give many of such men a cold shock if they knew that in some mills to-day there are many bordered patterns being produced on regular machines, and with no extra dobby harnesses used either. Of course, there is a limit to the pattern which can be produced, but it is done, and to the buyer's satisfaction too. It requires a thorough knowledge of patterns and methods employed to produce them, also a keen insight for adapting cloths to conditions existing, but fabrics have been and are being produced along these lines, and they are practical running jobs too. This shows how narrow some will become when their product is confined to a few lines of staple cloths. To have a knowledge of manufacturing and adaptability, it is necessary for a designer to be acquainted with the designing and making of many various cloth constructions, for it is only by this method that a general and accurate knowledge can be obtained. Men become narrow and fall into a rut when new and trying problems are not continually met and solved.

The

WEIGHT OF THE CLOTH

is found in the usual manner. If this weight be compared with the original grey weight, it will be found that the cloth is much lighter when finished. This is due to a number of reasons, among which are the facts that the silk is lighter because of the bleaching and boiling out, the cotton is lighter due to handling, and there is a certain stretch in finishing which gives more yards of cloth than when the cloth is first woven. In dyed yarn many men have been in the habit of assuming that the weight added by dyeing just about balanced with the weight lost in handling; that is, dyed yarn in a finished fabric was about the same size as it was previous to dyeing, warping, spooling, slashing and weaving, but this is not true in the majority of cases, for the dyed yarn will be finer than it was when made. In cloth analysis, there have been many facts assumed which do not hold true. It is only within a short time that any accurate tests have been made regarding manufactured and finished cloth, and few men have ever been in positions to make tests on both fabrics which would be accurate, because it requires a whole series of experiments on identical cloths to establish facts, and even then, results may vary in the different finishing plants. To treat all cloths in the same class and assume the figures are correct as has been done in the past is entirely wrong. Not only has the above been done, but many have also assumed that the weights given in any finished cloth should be practically identical with the grey or mill weights. A few experiments on identical cloths would show how fallacious this theory is, especially in the fabrics made by the newer mills. To get any figures which are reliable, experiments should be made freely at various stages until cloth is finished. This is not done to any extent by manufacturers, and, of course, buyers care but little for such details, and it is known that many of the results which are assumed are given by analysts, who compare similar fabrics, but as stated above, such results are unreliable. To have facts correct, a man must know much practical manufacturing detail, and then by correct theory establish results which will prove useful. Accurate statements cannot be obtained unless theoretical and practical knowledge be combined.

INSTRUCTIONS FOR DYEING.

The only color to be considered in this sample is the black dyed on the cotton warp. In the preparation of this fabric, it is not desired to have a very full shade of black, as this would take away from the general color value of the woven fabric. This

warp is dyed in the sizing and the following procedure is recommended:

Use three pounds of oxy diamine black AW, one-quarter pound diamine fast yellow A, and 10 gallons of boiling water.

When the dyestuffs have been thoroughly dissolved, cool the solution to 140 degrees Fahrenheit and then mix with 10 gallons of size. This size is prepared by using 120 gallons of water, 80 pounds of starch, 20 pounds of dextrine and 20 pounds of Turkey red oil. These ingredients are boiled up together until a thoroughly homogeneous solution is obtained. The cotton warp is dyed in this size by passing through a size box and squeeze rolls and then is carried directly on to the dryer, which may be either the ordinary slasher warp machine or through the more recent form of hot air warp dryer. This method of dyeing is very cheap and economical, and though it does not yield very high-class colors with respect to penetration, beauty of shade, or fastness to the various agencies, nevertheless, for the fabric under consideration, this process gives a color amply sufficient for its needs.

PATTERN.

40/1 American carded	2		2	=	1,106
30/1 American carded	—	1,840	—	=	590
10/1 American carded	16		16	=	208
					1,904 total ends.

32/38 2 end tussah tram filling; 64 picks.
33 reed, 28⅜" width in reed, 26" grey width, 26" finished width; 72 × 64 grey count; 72 × 60 finished count.

YARNS.

	Cotton.	Labor, waste.	
40/1 Am. carded, 1⅛" staple, 8 hank double roving,	16c.	7¾c.	= $ .23¾
30/1 Am. carded, 1¹⁄₁₆" staple, 6 hank double roving,	14c.	5¼c.	= .19¼
10/1 Am. carded, 1" staple, 2 hank double roving,	11c.	2½c.	= .13½
32/38 2 end tussah silk, 55,000 yards per pound. On quills			= 1.75

COST.

1,106 ends, 40/1 American carded..........+ 6% take-up	= .0350	@ $ .23¾	=	$ .0083
590 ends, 30/1 American carded..........+ 6% take-up	= .0249	@ .19¼	=	.0048
208 ends, 10/1 American carded..........+ 6% take-up	= .0264	@ .13½	=	.0036
64 picks, 32/38 2 end tussah silk......................	= .0330	@ 1.75	=	.0578
Weaving				.0135
Expenses				.0176
Jacquard cards				.0004
				$ .1060
Selling				.0021
Mill cost				$ .1081
Finishing, dyeing, etc..				.0250
Finished cost				$ .1331

Yards per pound, 8.38.
Retail price, 30c.
Mill selling price, 14 to 14½c. when this cloth was bought.

COTTON SUEDE

This fabric is the one which is creating a large amount of interest at present in the market. Many expressions have been heard regarding the cloth and the finish applied. Most of the cloth seen up to the present time has been imported, and is selling for about $1.50 per yard. There are many sellers in the market, who, from appearances, seem to try to create the impression that no cloth of any value can be made or finished in America satisfactorily. If there is anything which they can say against cloth of domestic production, it is stated as strongly as possible. This has been done on the cloth in question, and has also been done on the new toweling fabrics, when the facts are that the fabrics can be made satisfactorily, and much cheaper here than they can be imported. From instances which come to light sometimes, it is wondered whether some of the domestic product is not used as

imported by these same sellers.

This cloth is a domestic article. It is not to be wondered at that few mills care to make the cloth, for it is exceptional in a number of ways. First, the yarns are much finer than many mills care to make, as they are about 90-2. Second, the count is high, both in warp and filling, namely 132 by 188. Third, the weave is one seldom seen on cotton cloth, as it is a sort of double cloth, the face and back weave being a four-harness broken twill. There are no extra threads used in making the weave, but the effect is similar to a double cloth, although it is not one strictly speaking.

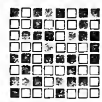
The price quoted for this cloth is 32 cents per yard. Under the circumstances, this price seems to reflect

VERY POOR MERCHANDISING,

for a larger amount should be obtained for a number of reasons. One is that this fabric is distinctly a novelty of the highest order, another is that the profit secured is not large, as will be explained later, while most important is the fact that this cloth will probably be sold as imported and is now retailing at about $1.50 per yard. There will be little competition on this fabric as made, and it is thought a higher price should be obtained than has been asked. Cheap imitations of this cloth cannot be produced for the fine yarns used, and the high count, together with the finish, do not admit large possibilities in this direction. From our analysis, it will be seen that the cost of production is about 28 cents per yard, while the selling price is 32 cents per yard, or a profit of about four cents per yard. This cloth has 188 picks per inch, and the production is very low, and under the conditions, the profit would not be over $2.50 per loom per week, or a profit of about $125 per loom per year. This might give a profit of somewhat over 10 per cent on capital invested, but this is not enough for the character of fabric. There is more ability required to make this cloth than the toweling fabric being sold, and it is known that cloth of this nature has been sold recently at less than 15 cents per yard, and a profit of over $10 per loom per week obtained, or a rate of profit of over $500 per loom per year. The prices of the cotton suede and toweling cloths are identical at retail, and without question, the cost of producing the suede is twice that of the toweling, so we are free to admit a mistake was made when no more was charged than 32 cents for the quality of suede offered; in fact, it is doubted whether the majority of fine mills which could make this cloth could do it as low as we have figured, that is, and produce a good result, and a low percentage of seconds.

There is no need of showing a drawing-in draft, as the warp would probably be drawn in straight on eight harnesses, although the weave actually takes but four. The selvages would be made on two extra harnesses. We give the weave so that

The Weave.



the arrangement can be noted. The second, fourth, sixth and eighth picks represent the filling which shows on the back of the cloth, while the remaining picks show on the face. We have no doubt that claims made that the unsatisfactory finish produced is due to poor manufacture or cloth construction is true in some instances, for the cloth weave and yarns have much to do with good finished results.

Cloths of this character are practically always

WOVEN IN THE GREY

state and then bleached and dyed, for bleached yarns are seldom used, and if they are the cost of manufacture is too high to be practical.

As yet, we have seen none of this kind of cloth which has been woven on a jacquard loom with a fancy pattern. There is a possibility of this development being a good thing, for the ground cloth could be made like sample, and because of the high count used, beautiful patterns could be made in a subdued effect. This would appeal to many consumers. Regarding

the cloth as sold at present, we are free to say that it is one of the best appearing, and has more quality than very many of the various fabrics offered in recent years. Of course, whether a large sale will result or not is largely a matter of conjecture, but one thing is certain, and this is that the price will never be as low as on ordinary lines, and it is doubted greatly whether it will sell later at less than $1 per yard at retail, even of domestic make. There never will be a large supply, no matter how large the demand gets, for to have the result satisfactory quality must be put into the cloth, and there are comparatively few mills which can produce this quality. Possibly one dozen mills would complete the list which could make this cloth in quantity to sell at 32 cents per yard and realize a profit. Because of slow production, the cloth will tie up a loom for quite a time. It may be that this seller was willing to quote this low price because of the lack of orders for fine cloth, and desired to get work to keep looms in operation, which this cloth would do to anyone's satisfaction, but the fact remains that probably a price could have been obtained which would approach 40 cents per yard just as easily as 32 cents could.

Regarding the imported prices and those of domestic make it is a known fact that on certain fine cloths, quotations have been asked for on cloth made in this country of foreign mills, and the prices quoted in many instances are but from 3 to 10 per cent lower than that at which mills have sold the cloth here, and carrying charges will range about 4 or 5 per cent, so it can readily be seen what economies the domestic manufacturer adopts.

From observation, it seems as if merchandising was the large item which needed to be watched carefully by many mills selling fine and fancy cloth. It is known that many of the newer fine and fancy mills are operated about as closely as is possible, so far as actual manufacturing is concerned. The interchange of ideas and prices among the cloth brokers and the system of selling in many cases operate against the mill obtaining the legitimate recompense for initiative and ability. Many times buyers would have willingly paid higher prices excepting for the fact that they were posted regarding prices by intermediates. This only added to the buyer's profits what should have gone to the maker, for prices to the retailer or jobber are never changed by such a lowering of prices. We have seen instances where makers have been deprived of a fair profit when there should have been a fair profit for all concerned. Manufacturing has been reduced to a very scientific process, and costs of making are known pretty accurately, yet while manufacturing has been getting on a closer basis, merchandising has been getting more expensive. A little of the accuracy which is employed by mills injected into some of the methods of selling would work wonders in the trade. There is no question but that selling has run into a very bad rut, and it will require time and almost a revolution to put it on a better or different basis. We believe the men who have shown such ability in the economies of manufacture are fully capable of showing new ideas in selling, and that to obtain a more regular profit and to be dictated to less by buyers, mills must eventually have more power than they at present have. Consolidation of interests must be effected in some manner to put manufacturing on more stable basis. The method of obtaining the weights and yards per pound is as follows:

3,960 ends ÷ (90/2 × 840) = .1048, warp weight without take-up in weaving.

Weaving take-up 12%.

.1048 ÷ .88 = .1191, total warp weight in 1 yard of cloth.

$$\frac{188 \text{ picks} \times 33'' \text{ loom width} \times 36''}{36''} = 6.204$$

yards of filling per yard.

6,204 ÷ (90/2 × 840) = .1641, total filling weight in 1 yard of cloth.

.1191 + .1641 = .2832, total weight per yard.

1.0000 ÷ .2832 = 3.53 yards per pound.

PATTERN.

	2		2		
90/2 Sea Island	24	3,864	24	=	3,960 total ends.

90/2 Sea Island filling; 188 picks.
60 reed, 33" width in reed, 31" grey width, 30" finished width; 132 × 188 finished count.

YARNS.

	Cotton,	Labor, waste.	Twisting.		
90/2 Sea Island; 1⅝" staple; 18 hank double roving,	28c.	32c.	7c.	=	67c.
90/2 Sea Island filling. Same as warp.				=	67c.

COST.

3,960 ends, 90/2 Sea Island + 12% take-up	= .1191 @ 67c.	=	$ .0798
188 picks, 90/2 Sea Island	= .1641 @ 67c.	=	.1104
Weaving			.0452
Expenses			.0394
			$ .2748
Selling			.0055
Grey cost			$ .2803
Dyeing, finishing, etc.			.0200
Finished cost			$ .3003

Yards per pound, 3.53.
Mill price, 32c. per yard.
Retail price for similar fabrics, $1.50 per yard (imported).

RUSSIAN CORD VOILE

We have in the past analyzed various patterns on voile cloths. Inasmuch as these fabrics will be used more largely than any other the coming summer, it may be well to add another novel combination to the ones already given. This cloth is made with a voile ground which is exceptional for the reason that the yarns used are of fine character, namely, 120s-2, and few mills in America could make them in any quantity. Cloths of this character are used for various purposes, and all have a rather low count. The majority use yarn up to 60s-2 and a count of about 50 square, although some mills make finer yarn with a somewhat closer count. Many of the patterns being offered at present have silk for decorative purposes, and this gives an added attractiveness for a comparatively small added expense. In some instances, artificial silk is being used for this purpose instead of the real article, and results are very satisfactory, although for other purposes it does not have such a large success. In

THE CONSTRUCTION

of a voile cloth much ability is required to get the best appearance. It is necessary to have the cloth open and still not slip badly. There is one thing which helps largely in producing a good voile, and this is good yarn. If yarn is poor, no weaving or finishing will give the result wanted. The yarn is not ordinary two-ply, but it is two-ply with a much harder twist than is usually given. This makes a smooth, round thread and gives a clear looking cloth. Some makers use gassed yarn, which ensures an added smoothness to the result. The yarn made determines to an extent the count necessary to secure satisfactory woven cloth. The standard of twist given the two-ply yarn will vary from about 6 to 8. In twisting, the hard yarn is likely to cut the travelers and cause trouble. Some mills have twisted their ply yarns on regular spinning frames and secured better results, for the rings are smaller, and not only this, but the ply yarn used for filling is ready for the loom when twisted, with no additional processes, which are necessary if twisted on a regular twister.

ENAMELED BOBBINS

can be used, the yarn being steamed and a saving made in time and expense.

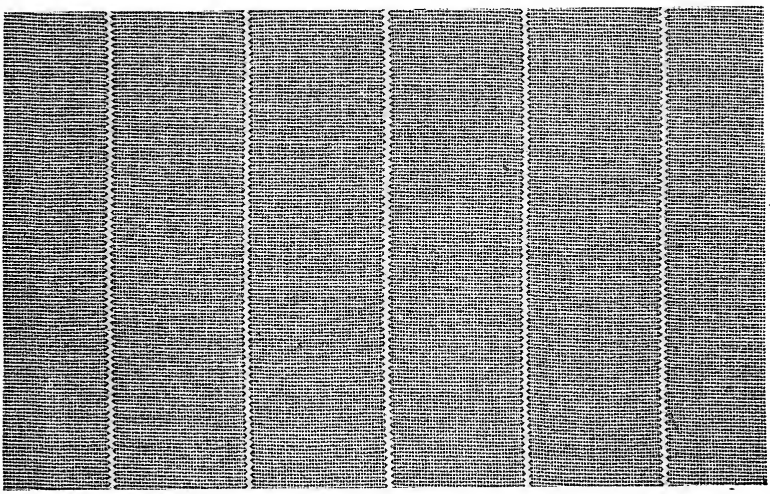
These fabrics, contrary to the belief of many, are not so expensive to make as would appear, for the count is usually low, the cloth weight light and the production comparatively large per loom. For this last reason, a smaller profit per yard will yield a better return than on many other lines

of fancy fabrics. Most of the various lines of voile cloths are made from grey yarns, and the fabrics are finished when woven. There are a few voiles made of bleached and dyed yarns, but they have been constructed this way to produce certain results. If two fabrics could be made so that the results would be the same when finished it would be found that the use of grey yarns would produce the lowest cost of manufacturing. There is no doubt but that this method of making cloth is driving orders from many of the older mills.

The cloths we are considering could be made in

THREE METHODS:

First, by using bleached and dyed yarns. Second, by using grey cotton yarns and fast colored silk to stand the bleaching process. Third, by using grey cotton yarns and raw silk and then bleaching and cross-dyeing the result. Possibly, the last mentioned method is the more common one on this identical cloth, and it would probably give the cheapest cost price. In these days of competition, the one who produces a certain effect for the lowest price gets the business. Many have thought there was little competition in the making of fancy fabrics, but they were never more mistaken, for competition is sharper on some of these cloths than on some of the coarser better-known lines.

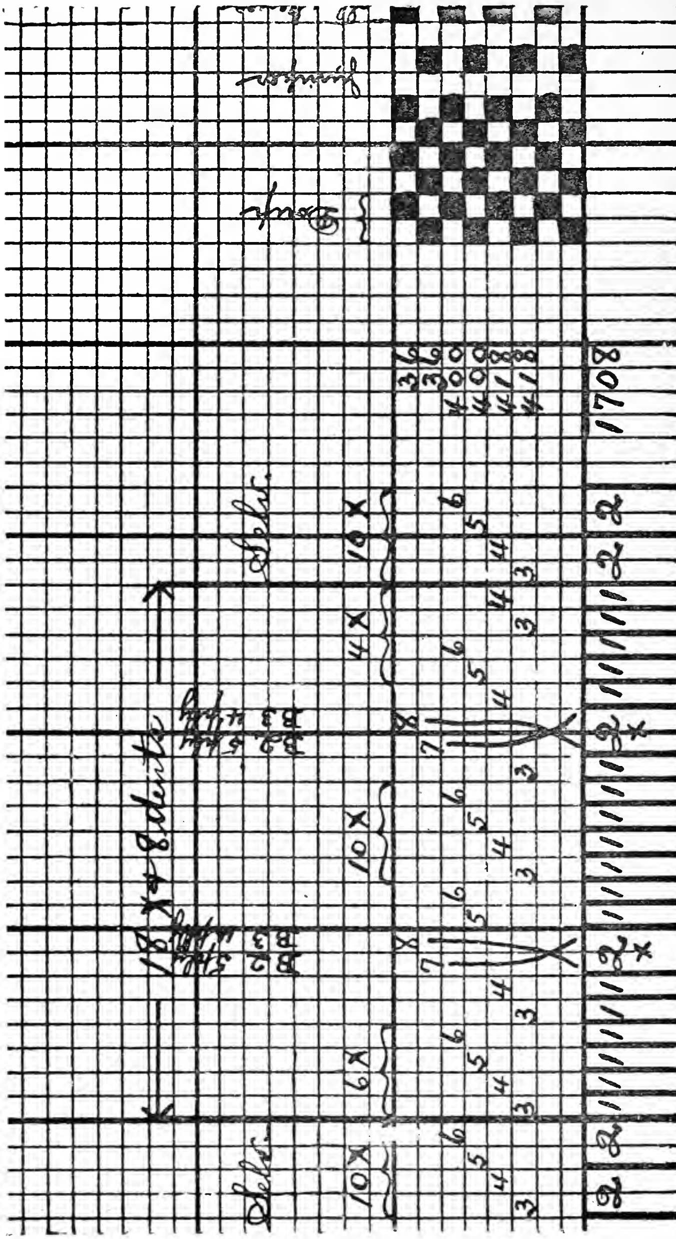


Russian Cord Voile.

Many of the fabrics being sold have silk stripes of varying widths in their make-up, and they are woven on jacquard looms. Few of the patterns are made on dobby looms, for it requires quite a few harnesses to produce any satisfactory figure on a closely woven silk stripe. This brings us to the item of interest in the cloth we are considering. This fabric is made on an ordinary dobby loom, and requires few harnesses to weave. It is

A COMBINATION

of the weave which was popular for men's shirtings last season and which is being used extensively at present with the voile ground. This is what is called a Russian cord. It consists of a cord of a more or less heavy nature and a leno end which crosses back and forth every pick, effectually covering the cord underneath. Sometimes this crossing end is of grey yarn, while other times it is of silk similar to sample, and in still other in-



Drawing-In Draft.

stances, it is of fast color cotton yarn to stand bleaching like the large number of men's shirtings produced.

Some time ago there were certain weavers who believed that no leno similar to a Russian cord could be produced by the use of top doups. They thought that before a crossing could be satisfactorily made with a top doup one pick would have to intervene. For this reason, many of these fabrics are woven on bottom doups. As is well known, top doups are more satisfactory if they can be run, and it is brought to the attention of those who still use bottom doups that many manufacturers are to-day using top doups for cloths of this character. We have given

THE CHAIN AND DRAFT

for the use of bottom doups, for it is probable that the majority still use them, and it makes things somewhat clearer by this method. The combination as produced is very pleasing, and it is such ideas as these which sometimes bring large profits to the originators. There are few new ideas in ground cloth construction, but there are unlimited possibilities in combinations, for new ideas in designs and dyeing and finishing admit of new results. This is illustrated clearly by the large use made of ideas when cloth began to be mercerized in the piece, also when yarns began to be dyed colors which would stand the bleaching process. It is not believed that either of these ideas have yet been developed as fully as possible. The use of fast colors on silk yarn has hardly been brought before the public, so there may be possibilities in this direction. The making of cotton suede opens a field which has been tested but little in cloth making. Because of the low number of picks in a voile cloth, the Russian cord effect is not as good as on many shirting fabrics which have a higher count in the filling, but

THE RESULT

is good enough to be noted in this connection.

Good yarn for the doups is of hard-twist worsted, and it may be well to bring out the fact that care in weaving such fabrics will save quite a

PATTERN.

120/2 Sea Island combed, hard twist	40	26			17	8	40	=	1,636 ground
60/2 Am. combed			5/1					=	180 cord
60/2 Spun silk				4/1				=	144 leno.
		36×						=	1,960 total ends.

120/2 Sea Island combed, hard twist filling. 58 picks.
58 reed, 28¾" width in reed, 27" grey width, 26⅜" finished width, 72 × 58 grey count over all, 74 × 56 finished count over all, 63 × 56 finished count ground cloth.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.		
120/2 Sea Island hard twist; 1¾" sta.; 24 hank dou. rov.,	30c.	58c.	18c.	=	$1.06
60/2 Am. combed; 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.	4c.	=	.44½
60/2 Spun silk; 50,400 yds. per lb. Ready for loom				=	3.50
120/2 Sea Island hard twist filling. Same as warp				=	1.06

COST.

1,636 ends, 120/2 Sea Island hard twist	+ 8% take-up	= .0353	@ $1.06	=	$ .0374
180 ends, 60/2 Am. combed	+ 2% take-up	= .0073	@ .44½	=	.0033
144 ends, 60/2 spun silk	+ 70% take-up	= .0097	@ 3.50	=	.0339
58 picks, 120/2 Sea Island hard twist		= .0331	@ 1.06	=	.0351
Weaving					.0109
Expenses					.0143
					$ .1349
Selling					.0027
Grey cost					$ .1376
Finishing, etc.					.0250
Finished cost					$ .1626

Yards per lb., 11.71.
Retail price, 45c. per yard.

little in the cost of production. Unless there are a large number of leno ends a weaver can operate nearly the same number of looms as on ordinary work. The loom speed will be somewhat slower, due to the fact that the doup yarn takes some time to straighten out. Through wrong designing or planning we have seen patterns which might have been profit producers become bad running jobs and continual trouble makers. It is necessary to bind the leno on the correct picks in making fabrics of this nature. We have seen cloths woven in large quantities which when finished showed but a straight line and no crossing end. It is needless to say that such a weave should never be used, as it will result in cancellation of orders and

LOSS OF PROFITS.

Some manufacturers make their voile yarns to size a specified amount while others use certain size single yarns, and let the two-ply result be what it may. Because of the hard twisting used the yarn will in most cases be heavier than the sample yarn would indicate, that is, 50s-2 will actually size about 48s-2. The take-up on the leno or crossing end is about 70 per cent on the cloth in question, that is, 3 1-3 inches will weave 1 inch of cloth.

The weights and yards per pound are obtained as follows:

1,636 ends ÷ (120/2 × 840) = .0325, warp weight without take-up in weaving.
.0325 ÷ .92 = .0353, warp weight with take-up.
180 ends ÷ (60/2 × 840) = .0071, warp weight without take-up in weaving.
.0071 ÷ .98 = .0073, warp weight with take-up.
144 ends ÷ (50,400 = 60/2 spun silk) = .0029 silk weight without take-up.
.0029 ÷ .3 = .0097, total silk weight.

$$\frac{58 \text{ picks} \times 28\tfrac{3}{4}'' \times 36''}{36''} = 1{,}667.5 \text{ yards of}$$

filling per yard of cloth.
1,667.5 ÷ (120/2 × 840) = .0331, weight of filling yarn.
.0353 + .0073 + .0097 + .0331 = .0854, total weight per yard.
1.0000 ÷ .0854 = 11.71 yards per lb.

SILK MIXTURE EPONGE

The cloth considered here is interesting in that it is a development of eponge, which many have purchased and of which many qualities have been produced at as many different prices. Possibly, eponge cloth for a novelty fabric has allowed of more and greater variations than any other recently produced. It is made in novelty yarn warp and filling, in novelty warp and plain filling, in plain warp and novelty filling, in silk and cotton mixtures similar to the sample we are now considering, in dyed yarn fabrics, mercerized yarn fabrics and various combinations of colors in various kinds of yarns. Possibly, mills have had about all the orders they will have for the present on these cloths, but retailers are becoming interested, and a fair distribution is likely for such a high-class novelty. It is true that of late the interest is being largely seen on similar ideas of this nature worked up into trimmings and the like, and the demand should be extensive in this direction, for these effects are more desirable for trimmings than they are for whole dresses. Many of the cloths are still imported, although cloths of

AMERICAN PRODUCT

have largely replaced them, at least in the cheaper grades.

Misstatements by men supposed to be familiar with cloth making have been made about these fabrics, possibly to a larger extent than on many novelty cloths. Because they never have had any experience in making novelty yarns, they consider that they are impossible to produce. For this reason, it is likely that more people have paid high prices for these cloths than for the majority of fancy fabrics. One thing is very evident, and this is that no cloth of a radical nature can be sold in comparatively large amounts until consumers are interested in the idea, or a fashion is worked up for the cloth. Contrary to the general opinion, any large sale of a different cloth is a growth and should be treated as such by buyers.

NOT A NEW IDEA.

The idea used in these cloths is not new, for it has been used at various times, but no demand was created and therefore no sale made. We have

seen good and practical ideas thrown aside by buyers simply because they did not care to attempt to develop their use. The yarns used in these cloths are called, in mill language, under the general heading of cork-screw yarns. To produce the effects, two twisting operations are necessary, one in the opposite direction to the other. In the yarn in this cloth, instead of all single yarns being used, we have two sizes of two-ply. This makes a better effect, although it increases the cost of the yarn somewhat. If the yarn be made on the twister, it is necessary to have two sets of rolls, for the yarns are not delivered at the same rate of speed, as can be seen from the yarn analysis. If

NOVELTY TWISTERS

are not available, it is possible to make the same effects on an ordinary spinning frame, using two sets of rolls and a wire across the front of the frame to hold up the ends off the other rolls and guide them into the pig-tails on the frame. This policy is sometimes advantageous, for yarn in the last twisting process can be wound directly onto quills, thereby saving some operations which are necessary when yarn is twisted on a regular twister. Yarns of this character usually are coarse in size when completed, possibly few being over 7½ and many less than 5, although at various times samples have been seen with yarn which sized when finished as fine as 20. Because of the coarse size of the yarn, the cloth count is necessarily low in the direction which the novelty yarn was used.

To find the resulting yarn size when completed, it is only necessary to pull threads from the cloth and size in the ordinary manner, this process giving 5.45 as the yarn size; but to obtain the various yarns which enter the construction is another thing. The first step is to unravel some of the ends composing the novelty, being careful to measure their lengths. In this manner it will be found that the 40s-1 yarn takes up 9½ per cent, while the 30s-2 takes up 30 per cent. When the yarns are unraveled, it is an easy matter to obtain the various sizes. Care should also be observed in the amount of twist per inch in each operation of twisting, for this has much to do with the final effect. When the above has been completed, the size which the yarn should be is obtained.

60/2 1 end	=	30/1		= 30/1
40/1 2 ends	=	20/1	9½% shrink.	= 18.1/1
30/2 1 end	=	15/1	30% shrink.	= 10.5/1
30/1 ÷ 30/1	=	1.00		
30/1 ÷ 18.1/1	=	1.65		
30/1 ÷ 10.5/1	=	2.85		
		5.50		

30/1 ÷ 5.50 = 5.45 figured size.

PRICES DO NOT CORRESPOND.

To show that prices on various quantities of fabrics do not correspond when retailed, we can state that an all-cotton fabric was being retailed at a higher price than the silk one analyzed in the same store. Some may think that the construction warranted the difference, but we can state that there was practically the same number of picks of novelty yarn of the same size as filling in each cloth, so little difference could be found here. The warps bear no comparison, for the cotton warp was plain yarn of a count of about 29 threads per inch of 30s-1 yarn, while the silk warp counts over all nearly 150 per inch. An absolute difference in cost of warp material of over 10 cents per yard is noted, making the cost of the grey cotton cloth less than 12 cents per yard. Another item of expense which the white cotton cloth did not bear was the extra cost of dyeing and finishing a novelty silk and cotton fabric. Altogether, the net cost finished of the silk and cotton fabric was nearly, if not quite, twice the cost of the all-cotton one, and the retail price of the all-cotton fabric is higher than the mixture cloth. This shows how the retailer, many times, purchases fabrics which show no relation of manufacturing costs to selling prices.

There is as much demand for one of these fabrics as there is for the other, and no excuse can be offered that one is sold at a lower price because of small demand. If the novelty mixture sells for 96 cents per yard,

the all-cotton fabric should not bring over 50 cents per yard. These cloths were purchased through the same channels, and it is very evident that some one made

EXCESSIVE PROFITS

on the all-cotton cloth. It is true that cloths of all cotton, and very similar to the one referred to, have been sold for less than 13 cents per yard, and even at this price, they have given large returns for the mill making them. This is due to the fact that a loom will produce a large number of yards per day, due to the small number of picks. Because of the fact that the filling is so heavy, a weaver can operate but one loom in many cases. As a large part of the weaver's work is the changing of filling, the cloth is called a filling job. Many times it would be possible for a weaver to operate more looms, thereby reducing the producing costs, excepting for the fact that the filling runs out very fast. If more than one loom was operated, it is likely that the percentage of production would be low and the ultimate result no better than if but one loom per weaver were run.

In making cloth with silk warps, a mill usually will use the silk which they find best suited to their looms or

METHOD OF WEAVING.

Italian silk is probably used in large quantities, and the sizes are almost always heavier than 20s-22, so as to obtain a sufficient amount of strength. We have used 190,000 yards as the size of the yarn, although this is not the theoretical yardage. A certain

PATTERN.

22/24 Italian silk warp $\frac{4}{24}$ 4,892 $\frac{4}{24}$ = 5,084 total ends.
5.45 cotton novelty filling, 20 picks.
65 reed, 38" width in reed, 36" grey width, 35" finished width, 141 × 20 grey count: 145 × 20 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.		
40/1 Am. combed, 1⅛" sta.; 8 hank dou. rov.,	17½c.	10c.		=	$ .27½
30/2 Am. combed, 1⅛" sta.; 6 hank dou. rov.,	17½c.	8½c.	2c.	=	.28
60/2 Am. combed, 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.	4c.	=	.44½
22/24 Italian silk, 190,000 yards per lb. On beams,				=	4.45

NOVELTY YARN.

40/1 2 ends ground 9½% take-up in finished yarn }
30/2 1 end 30% take-up in finished yarn } 1st twisting regular.
60/2 1 end }
Yarn from 1st operation } 2nd twisting reverse.

Note.—60/2 in 2nd operation is the yarn on which all the weaving strain comes. The first twisted yarn is really retwisted around the 60/2.

NOVELTY YARN COST.

40/1 2 ends @ 27½c. = 8.28c......................for part to make 1 lb. of novelty.
30/2 1 end @ 28c. = 14.53c......................for part to make 1 lb. of novelty.
60/2 1 end @ 44½c. = 8.52c......................for part to make 1 lb. of novelty.

31.33c. yarn cost.
3.00c. 1st twisting operation.
2.00c. 2nd twisting operation.

36.33c. novelty yarn cost at loom.

CLOTH COST.

5,084 ends 22/24 Italian silk + 8% take-up	= .0291 @ $4.45	=	$ .1295
20 picks 5.45 novelty cotton	= .1660 @ 36.33c.	=	.0603
Weaving			.0242
Expenses			.0053
			$ .2193
Selling			.0044
Grey cost			$ .2237
Dyeing, finishing, etc.			.0300
Finished cost			$ .2537

Yards per pound, 5.02 (grey).
Plain weave.
Retail price, 96c. per yard.

amount of leeway is usually allowed by cotton mills using silk for any variation which may be noted in the actual size. Naturally the maker errs on his own side and possibly it should be considered justifiable, inasmuch as silk sizes purchased from different sellers vary widely.

Regarding the use of silk in cotton mills, it can be said that it has largely increased in the past few years. Possibly the use may be applied to new cloths as they are demanded by fashion, but there is no question but that its use has come to stay in this direction. A fancy goods mill which has not or cannot use it is rather badly handicapped in the production of high-class novelties. It is true that many times the addition of a comparatively small amount of silk will add very much more to the value of the cloth than the extra charge would indicate. In other cases, a cloth is changed from a rather ordinary fabric to a beautiful production. Numerous examples might be cited where the use of silk was a distinct advance in the making of cloths, and not only this, but many times it has added to the profits of all concerned in the selling, from the manufacturer to the retailer. When the actual size of the filling is obtained, the

YARDS PER POUND

are figured as follows. It must not be assumed that the weight of the cloth is the same when finished as when delivered by the mill, for silk will lose much weight when bleached and boiled out, and cotton is also lighter, due to processing.

5,084 ends silk ÷ 190,000 yards = .0267, silk weight per yard without take-up.
8% take-up in weaving.
.0267 ÷ .92 = .0291, silk weight per yard.

$$\frac{38'' \text{ width in reed} \times 20 \text{ pks. per in.} \times 36''}{36''} =$$

760 yards filling per yard of cloth.
760 ÷ (5.45 × 840) = .1660, filling weight per yard.
.0291 + .1660 = .1951, total weight per yard.
1.0000 ÷ .1951 = 5.02 yards per pound.

The finished yards per pound would be, probably, about 5.35 to 5.40, although this would depend much on the amount the cloth was boiled out in the finishing process.

SILK MIXTURE FAST COLOR SHIRTING

The fabric analyzed is one of the newer productions in shirting materials. As is well known, there is a wide distribution for various fabrics in these lines, and many and varied constructions are made and sold. While it has been noted but little, it is a fact that the materials used have been getting finer and finer, and much more silk is being used than ever before. Of course, the price of shirts has advanced, but this does not of necessity mean that the price of material has gone up in proportion. In many cases, it is known for a fact that cloth in some of the high-priced shirts has been bought at a lower price than cloth which has been used in some of the lower-priced articles.

This shows that some of the shirt makers, because of their progressiveness, have looked after their own converting on these cloths and have saved the large profits which may be made in this manner. Few of the old-style madras shirts had material which cost less than 15 cents per yard in their construction, and many had material which cost more than the above. It is known that much of the material which shirt makers have converted has been bought at 10 cents per yard or less. Much of the material which is used in \$3.50 to \$5 shirts costs less than 25 cents per yard. This is for

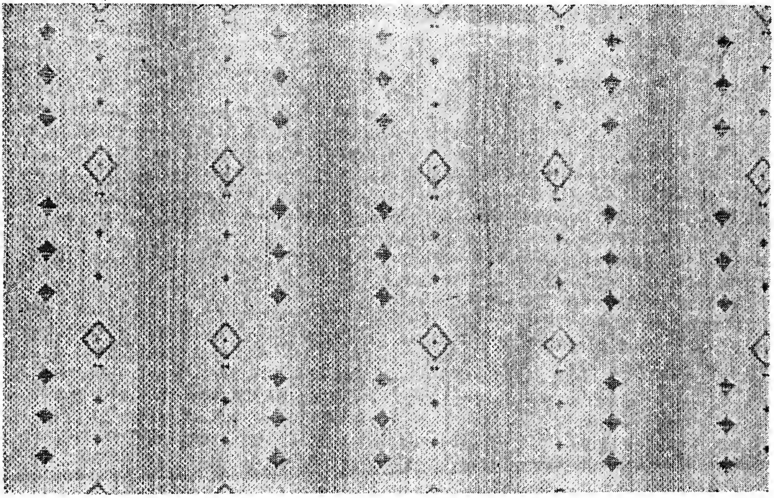
A NOVELTY CONSTRUCTION

containing spun silk filling and with enough picks per inch to produce a firm and satisfactory cloth, with silk warp stripes and figured patterns. Very few cloths ever used cost a maker over 75 cents per shirt, and the large majority of fabrics cost less than 50 cents per shirt.

One other advantage which is noted in many of the newer materials is that the cloths are made of all combed yarns. This should produce a more even and better looking cloth, and it usually does. Few of the old-style shirtings were or are made of any-

thing but carded yarns. Another thing which is noted is that the whites are not so clean in the older shirtings. This results from the fact that the yarns used in their construction are handled much after bleaching. Of course, the cloth woven is washed before shipping out, but this process many times cannot eradicate the shade obtained when processing. The above is shown very clearly by comparing the whites in many lines of the best ginghams with the whites in some of the checked patterns produced with yarn to stand bleaching, and which are bleached when the cloth is woven. Many of the older shirting mills use colors which are fast to light and washing, although there are still many of these fabrics which do not have satisfactory colors, but it is manifest that a color which has been through a bleaching process is better than one which can stand only light and washing.

Possibly, one of the first and largest uses made of these colors has been in mills which do not dye their own yarn, and which are usually known as grey cloth mills. They have been applied to shirting fabrics, in both carded and combed yarns and also to many novelty fabrics composed of silk and cotton, both for ladies' and men's wear. The sample considered is one of these novelty cloths. It has 40s-1 yarn for warp in both the white and color. Probably, these were run in the weave room on separate beams, although they could just as well have been placed on a single beam if facilities for doing this were obtainable. The fulling is of Tussah silk. The yards per pound are assumed at 55,000, yet this is not the theoretical yardage, but is one which protects the manufacturer from variations in the silk size. The cloth construction is not an especially good one, as it counts but 74 by 64, and would not make a highly serviceable shirting for men. What the difference is between the cost and retail price is easily seen. These cloths sold last year in quite large quantities for about 14 cents per yard, and it is very evident that a large percentage has been taken in the distribution. Of course, the price of the silk, which constitutes the largest single item in the cloth cost, is now lower than last year, but the difference in price accounts for a very



Silk Mixture Fast Color Shirting.

small portion of the extra cost. The retail price is 48 cents per yard, and probably was purchased by the retailer for 32½ cents per yard. The difference between 14 cents, the purchase price, and 32½ cents, the selling price, represents

THE GROSS PROFIT

to the converter after the finishing charges are deducted, and these should not be large, for the cloth has only to be bleached and finished. The fabric was probably sold by a converting jobber, for they handle these lines in large amounts.

The figure on the cloth is made on an ordinary dobby loom, and it takes 15 harnesses to produce it satisfactorily. In our drawing-in draft the numbers at the bottom represent the number of ends placed in each dent of the reed. The numbers in the draft represent the harnesses upon which draft is drawn, while the numbers to the right are the heddles required on each harness. These are for the harness builder, so that satisfactory harnesses with the correct number of heddles are available for the drawing-in operation. The head chain represents the operation of the various harnesses to produce the pattern. A somewhat more even repeat might have been produced if two plain picks were inserted in the chain, or if two were taken out. This would have obviated one defect in the pattern. It will be noted that in the pattern as woven there is a harness skip over the large spot.

Care should be taken by the loomfixer to see that such occurrences are rare, although it is hard to see them in grey cloth. This defect can be detected much easier, however, with Tussah, which is yellow, than with many other silks, such as 14-16 two-thread Canton which is used largely in these varieties of fabrics.

In laying out

THE PATTERN

another criticism might be made, and that is that the pattern would have looked better if it had been balanced. It is noted that the cloth has a heavy colored stripe on one edge, while the light stripe is on the other edge. We have laid out the cloth as it is woven, although in the large majority of cases, it is better to exactly balance the repeats next to each selvage. Of course, this is sometimes impossible when making a number of different patterns with the same number of col-

PATTERN.

40/1 Am. combed, white.......	2/12	38		48		2		10	34	2/12	=	1,954
40/1 Am. combed, colored......			14		2		2				=	432
					4 ×							2,386 total ends.
		18 ×										

32/38 2 end tussah filling. 64 picks.
34 reed, 34¾" width in reed, 32" grey width, 32" finished width. 74 × 64 grey count.
74 × 63 finished count.

YARNS.

	Cotton.	Labor & waste.	Dyeing.		
40/1 Am. combed, grey, 1⅛" sta.; 8 hank dou. rov.,	17½c.	10c.		=	27½c.
40/1 Am. combed, colored, 1⅛" sta.; 8 hank dou. rov.,	17½c.	10c.	16c.	=	43½c.
32/38 2 end tussah tram, 55,000 yds. per lb., on quills,				=	$1.80

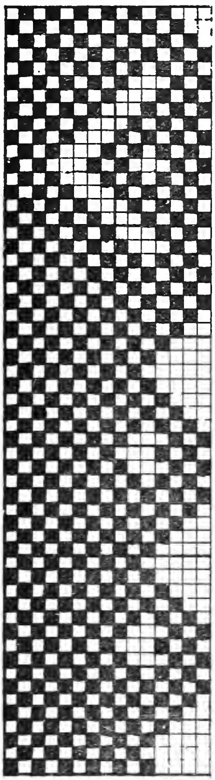
COST.

1,954 ends 40/1 Am. combed, grey..........+ 5% take-up	= .0612	@ 27½c.	=	$ .0168
432 ends 40/1 Am. combed, colored.........+ 5% take-up	= .0136	@ 43½c.	=	.0059
64 picks 32/38 2 end tussah tram..........................	= .0404	@ $1.80	=	.0727
Weaving				.0110
Expenses				.0142
				$ .1206
Selling				.0024
Mill cost				$ .1230
Finishing				.0150
Finished cost				$ .1380

Yards per pound, 8.68.
Retail price, 48c.

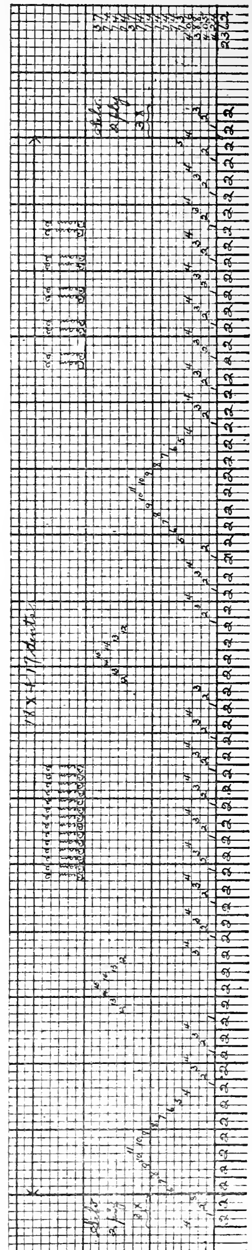
ored ends, although this situation hardly ever comes up. Many mills have been afraid of handling silk and cotton mixtures, although this condition should have been eliminated long ago.

The production is as high, if not higher, than with the same class of cotton fabric, and when workers become used to handling the material little trouble is experienced. Profits



Harness Chain.

have been large in making these cloths, but competition and the excessive prices charged by converting jobbers have stifled the demand somewhat. There is no reason why the cloth analyzed should not sell for less than 35 cents per yard and still allow all sellers a large and satisfactory profit. The silk used in these fabrics



Drawing-in Draft.

is rather uneven in size, but answers the purpose for which it was used satisfactorily. Large advances have been made in the finishing of these cloths, and to-day the finish is admitted to be as good if not much better than can be obtained from any of the foreign plants. In the finishing it is customary to bring the cloth out to its grey width, as the silk will admit of much greater stretching than the cotton filling. As yet no large number of patterns have been produced on jacquard looms, but without doubt, a large increase in various colors and combinations of material will be seen, while competition and a larger production will give more reasonable prices to consumers. To find the yards per pound the process is as follows:

1,954 ends ÷ (40/1 × 840) = .0582, weight of grey yarn without take-up.
5% take-up on all 40/1.
.0582 ÷ .95 = .0612, weight of grey warp in 1 yard of cloth.
432 ends ÷ (40/1 × 840) = .0129, weight of colored yarn without take-up.
.0129 ÷ .95 = .0136, weight of colored yarn in 1 yard of cloth.

$$\frac{64 \text{ pks.} \times 34\tfrac{3}{4}'' \text{ reed width} \times 36''}{36''} = 2{,}224$$

yards of filling per yard of cloth.
2,224 ÷ (55,000 silk yardage) = .0404, weight of silk per yard of cloth.
.0612 + .0136 + .0404 = .1152, total weight per yard.
1.0000 ÷ .1152 = 8.68 yards per pound.

MERCERIZED RUSSIAN CORD SHIRTING

At various times we have mentioned the fact that the process of mercerization and the use of fast colors had developed many new lines of shirtings and similar fabrics which fill a variety of uses. Not only have these processes made it possible to produce fine fabrics of combed yarn and with beautiful effects which could not be produced at any price until comparatively recently, but it has also made it possible to produce such cloths at low prices. That this has been of benefit to consumers thus early is easily proven by the cloth now under consideration. The price at retail is 35 cents per yard, and it is not too much to state that five years ago such a fabric could not have been purchased at any price.

Many of the ordinary madras shirtings bring 45 cents or more at retail to-day, and do not compare with the present cloth in either quality or construction. The facts are that many people purchase this cloth with the impression that it has a large amount of silk in its construction, and this idea is certainly justified by the appearance when sold. The gloss will not wash out, and the color will remain as bright when the cloth is completely worn out as it was when sold. Of course, there is not the wear to this fabric which there is in many madras shirtings, but no one should expect such a condition, for the cloth is lighter per yard and the yarns are much finer than most madras shirtings, but the fabric is a beautiful and serviceable one. To show that the cloth is comparatively

REASONABLE IN PRICE

when so new is shown by the retail price of 35 cents per yard, and also by the fact that made-up shirts have been offered and sold at retail in this cloth and pattern at 95 cents each. As it takes somewhat over 3 yards of cloth to produce a shirt, the discrepancy between the price of cloth and shirts at retail is probably due to the fact that the shirt make purchased the cloth very cheaply and from first hands, thereby saving quite a little. Never in the sale of such articles has the writer seen so much value and cheapness, especially in the cost of a new idea.

There are a number of interesting features which can be noted in the construction of this variety of fabrics. It has been found from experience that certain constructions are more suitable than others for this style of cloth. The warp is usually made of finer yarn and with a coarser count than the filling, and for this reason, the latter usually forms a larger part of the cloth, and the warp yarn is more or less covered up. One construction largely used for ground cloth is 64 by 72, with 50s-1 warp and 30s-1 filling; another is 64 to 72 by 92 to 104, with 70s-1 or 80s-1 warp

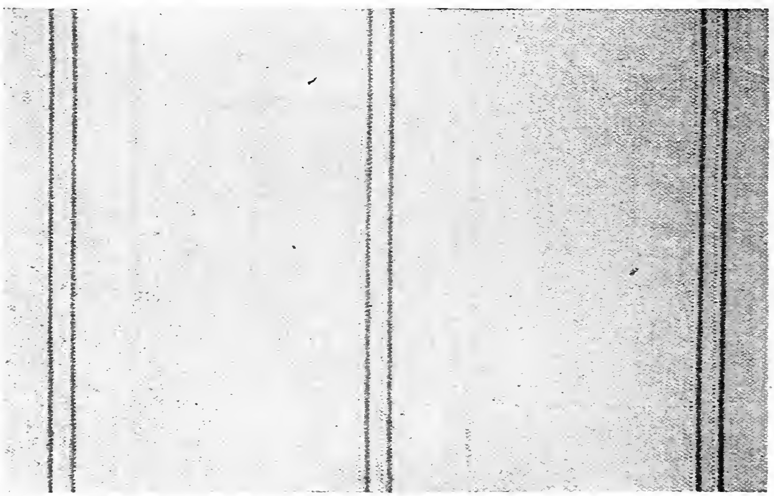
and 40s-1 or 45s-1 filling. Of course, many constructions are used, but

THE GENERAL IDEA

given above is nearly always present. Many buyers ask for a soiesette construction, while others ask for a suitable cloth for mercerization, although at present the yarns and counts are well enough known among buyers to be usually asked for. Many other yarns and counts are used, and cloth weights are heavier, in many instances, than on the cloth considered, being many times heavier than ordinary madras shirtings. Filling yarn is almost always made of combed material, and because results are better, the yarn usually has a comparatively small amount of twist per inch. The standard in many yarns made on ring frames possibly would be in the vicinity of 3.25, although standards of as low as 2.75 have been used on frames. Sometimes mule-spun yarn is used with less twist than that of ring yarn, but too small an amount makes a weak cloth. Because of the small amount of twist it is necessary, in many cases, to use longer staple cotton than on ordinary yarn. This method not only gives more strength to the cloth but also ensures a much larger production when the yarn is being made. In many

MERCERIZED FABRICS

various qualities of Egyptian cotton are sometimes used, as the results when finished are more satisfactory. Possibly, more of the cotton imported is used in cloths which are mercerized than for any other one product excepting hosiery and underwear. The large reason why ordinary madras shirtings do not possess the luster and appearance which many of these new cloths have is because they are not mercerized, and they are not processed in this manner, because the yarn used is twisted so hard that no satisfactory results are obtained. A comparatively large amount of twist is necessary in yarns for madras shirtings, so that the yarns can be handled, bleached and dyed in a satisfactory and economical manner. Many processes are eliminated when cloth is woven from grey yarns which are necessary and expensive when cloth is made from bleached and dyed material. The cloth is mercerized in the piece, and the filling, which, as above noted, is soft twist, takes prac-



Mercerized Russian Cord Shirting.

tically all the mercerization noticed. This makes it necessary that some method be used whereby the cloth is held out in the filling direction when the mercerization is taking place, for unless this is done, no luster will be imparted. This is done in various methods which are of little importance in the discussion excepting for the fact that this result must be produced by

HEAVY TENSION

on the filling in the cloth.

For a number of years grey cloth was mercerized in the piece, but, naturally, the resulting fabric did not compete with cloth in which color was used, excepting in an indirect manner, by eliminating some purchases, and rather new uses were found for the product. Then when this field was fairly well established, a new development ensued which as yet is only in its infancy. This is the use of fast colors which will stand the bleaching process. As will be readily seen, this process places the grey cloth mills which had previously produced cloths for mercerization in the white state into more or less direct competition with many of the older mills and fabrics, and without doubt, has opened new fields which as yet have hardly been touched. To show what this development has meant it can be stated that southern mills are to-day making colored lines in which the colored yarn is sent North to be dyed, and then reshipped to the mill to be woven into cloth which is today being sold at lower prices for the same construction than many of the older mills can possibly sell at. Few of the older mills could produce

FANCY JACQUARD PATTERNS

with colors in their construction, but now the supply can be made large with any demand. Another thing which will mean better cloth to the consumer is the fact that most of these newer fabrics are composed of combed yarns, and the finished results are much more even than many of the older cloths. Not only do the yarns make more even cloth but the finishing processes used on grey cloth eliminate to a large extent, or entirely, the reed marks which are more or less visible in cloth woven from bleached yarns, and which spoil somewhat the cloth's appearance. While the reduction in the cost of making is not so great on some fabrics as it is on others there is no doubt but that in a general way radical reductions are and can be made.

Possibly, one of the large results aside from the costs is the fact that the making of so many new cloths with absolutely fast colors will force buyers and makers into demanding much better colors than many have been accustomed to use. This does not apply to some of the mills which make older lines, for they have been quick enough to see the possibilities in the use of these colors and what it means to their future business, but there is very large

CHANCE FOR IMPROVEMENT

in the colors which some mills are accustomed to produce.

We have not gone into detail regarding the individual cloth under consideration. It is what is known as a Russian cord, and this portion is composed of the fast-colored yarn. Some mills make these results on an ordinary dobby loom with leno attachment and use either top or bottom doups, but possibly a large portion is made with a reed, which allows the ground of the cord to operate practically not at all, while it allows the crossing end free access to both sides of the ground yarn. The main fact is that the crossing thread is bound into the cloth first on one side of the ground yarn and on the next pick on the other side. This continual changing entirely covers up the ground threads, and because of the large number of picks makes a very smooth round cord which cannot be produced in any other way, for it appears when woven like a braid sewed onto the cloth. Due to

THE CROSSING PROCESS,

there is a large take-up on this leno or crossing yarn, and so great is this take-up that it requires almost six inches of yarn to weave one inch of cloth. Care must be used when cloth is made of this character, for any variation in the tension will produce a

different effect. This care should also be used when plain stripes of color are in the pattern, for most always the colored yarn is on a separate beam, and if the tension is not right a poorly-woven result is likely. This care is not so necessary when weaving in mills which use bleached yarn, for it is customary to place the different colors along with the white yarn on the same beam, and of necessity, the yarn would have the same take-up, although care is necessary when the colors are placed on the beam in the first place to see that none build up more than others. In the large majority of instances cloths such as the one considered lose in weight from

PATTERN.

70/1 Am. combed	24	68			6			36	30	24	=	2,168
30/1 Am. combed, colored			6/1			6/1					=	228
60/2 Am. combed, colored				1			1				=	38
		19 ×										2,434 total.

40/1 Am. combed filling. 100 picks.
31 reed; 35¾" width in reed, 34" grey width, 32" finished width.
66 × 100 (grey count ground); 76 × 100 (finished count over all).

YARNS.

			Cotton.	Labor, waste.	Twisting.	Dyeing.	
70/1 Am. combed, grey;	1⅜" sta.;	14 hank dou. rov.,	24c.	20½c.			= 44½c.
30/1 Am. combed, colored;	1⅛" sta.;	6 hank dou. rov.,	16c.	8c.		16c.	= 40c.
60/2 Am. combed, colored;	1⅜" sta.;	12 hank dou. rov.,	24c.	16½c.	4c.	16c.	= 60½c.
40/1 Am. combed, grey;	1¼" sta.;	9 hank dou. rov.,	21c.	11c.			= 32c.

COST.

2,168 ends	70/1 Am. combed	+ 5% take-up	= .0388	@ 44½c.	=	$ .0173
228 ends	30/1 Am. combed	+ 2% take-up	= .0092	@ 40c.	=	.0037
38 ends	60/2 Am. combed	+ 83% take-up	= .0088	@ 60½c.	=	.0053
100 picks	40/1 Am. combed		= .1064	@ 32c.	=	.0341
	Weaving					.0188
	Expenses					.0221
						$ .1013
	Selling					.0020
	Cost grey					$ .1033
	Bleaching, mercerizing, etc.					.0175
	Cost finished					$ .1208

Yards per pound, 6.13 grey.
Retail price, 35c. per yard.
Retail purchasing price, about 22½c. per yard.

THE FINISHING PROCESSES.

Of necessity, the yarns are finer than in the grey cloth or when spun, although this loss may vary to a large extent. In the cloth analyzed the warp yarn in the ground cloth actually sized 74½, and was probably 70s-1, or supposed to have been 70s-1 when made, and the filling sized about 45s-1 and was probably 40s-1. These sizes can only be assumed, for mill yarn sizes vary even when care is taken, and under the best of operating conditions. The reason the percentage of loss was greater on the filling may be due to the fact that the yarn was soft twist and to the process of finishing. No accurate tests have been made regarding yarn losses in finishing grey cloths, but from 7 to 10 per cent would be a fair average taken from a variety of fabrics. The twist in the yarn, the amount of stretch given the cloth, the kind and quality of cotton used, the process of finishing and other factors all affect the result somewhat. Possibly, any one mill could tell within reasonable limits what losses its own cloth would have, but they would apply only in a general way to cloths which others produced and which were completed by a different finishing works. Sometimes cloths which are mercerized lose in length and at other times they do not. The cloth construction has

something to do with the results, but on most of the grey goods which are finished but not mercerized, there is an appreciable stretch of greater or less degree, depending upon the cloth and conditions.

Inasmuch as some yarn has a large take-up in this cloth, it may be well to give the method pursued in obtaining the various weights of yarn:

2,168 ends ÷ (70/1 × 840) = .0369, warp weight of 70/1 without weaving take-up.
5% take-up in weaving on 70/1.
.0369 ÷ .95 = .0388, warp weight of 70/1 (total).
228 ends ÷ (30/1 × 840) = .0090, weight of 30/1 colored without weaving take-up.
2% take-up in weaving 30/1 colored.
.0090 ÷ .98 = .0092, warp weight of 30/1 colored (total).
38 ends ÷ (60/2 × 840) = .0015, weight of 60/2 colored without weaving take-up.
83% take-up in weaving 60/2 colored.
.0015 ÷ .17 = .0088, warp weight of 60/2 colored (total).

$$\frac{100 \text{ picks} \times 35\frac{3}{4}'' \text{ width in reed} \times 36''}{36''} = 3{,}575$$

yards of filling per yard of cloth.
3,575 ÷ (40/1 × 840) = .1064, weight of filling (total).
.0388 + .0092 + .0088 + .1064 = .1632, total weight per yard.
1.0000 ÷ .1632 = 6.13 yards per pound (grey).

MERCERIZED SEERSUCKER STRIPE

This cloth represents one of a class of fabrics which are having quite a sale at present, and one which is likely to be used extensively another season, for converters are getting out various styles along these lines. In a general way, these seersucker fabrics are of two kinds. In the first, the crinkle is woven in the cloth by a weaving process, while in the second, the effect is made by a printing process through the application of the principle of mercerization. Some time ago we gave the analysis of a woven crinkle, and the one now considered is of the second or printed variety. Of course, there are pressed fabrics which bear some resemblance to the printed fabric now considered, but they are not so satisfactory and are much less used, especially for dress purposes.

The patterns used in the past have been more or less

SIMPLE IN CHARACTER,

because of the method of producing, but some deviations from the older effects are now being seen, and it is very likely that a greater variety will be shown, especially in the offerings for another season. Most of the patterns shown are somewhat similar to the sample considered, having stripes of various widths and spacing, and with no delicate effects, which are possible through the weaving operations on other lines of fancy cloths.

The fabric considered shows one method of finishing, which produces a novelty effect from an ordinary plain fabric. Unquestionably, the large quantity of all kinds of cloth which is used is of the plain variety, and many times when finished shows little resemblance to the original fabric. Because of the numerous interlacings in plain weave cloths, there is usually much better service noted, and because of the simpleness of the processes employed in production the cost of most plain lines is low, and the distribution is larger and steadier than on other more expensive fabrics, which are in good demand when stylish, but which can hardly be sold when the season for wear is past.

Wide uses are found for this cloth, and from the appearances when finished, few people would imagine the results to be of

IDENTICAL CONSTRUCTION

when woven. To give the names which are applied to the various lines and the uses to which they are put would fill a small volume, but generally, they find a wide application, largely depending on their serviceability. It used to be thought by many mill men of the older school that the looms which could make nothing but plain weave were unfit to produce any novelties whatever. That this is a mistake is clearly proven by the results which some mills are obtaining, for they are making rather high-grade novelties for their class of goods, and are using cords in various patterns, together with fast

colors, producing goods on a print cloth basis which yield them a higher profit than their ordinary work.

As yet the manufacturing end of the business does not

SEE THE POSSIBILITIES

in the making of various fabrics which the finishing end has realized. It is probably true that many more improvements have been made in the finishing of cloth in the past ten years than there have been in the manufacturing. Due to the finishing processes, many fabrics could not be recognized by their maker, and this applies to plain and fancy cloths alike. The cloth in most cases shows a largely different appearance, and, except in few instances, the results are an improvement, and are better adapted for the uses to which the material is to be put.

The past year manufacturers have

REALIZED THE POSSIBILITY

of slight changes more than ever before, and it is very likely that one of the large advantages from the lack of business will be the teaching of manufacturers to adapt ideas to the weaving possibilities. This does not mean that a plain mill need be turned into a novelty one, but that through adaptability increased profits can be made with the machinery in use. This has been one part of the manufacturing trade which has been largely overlooked in recent years and one which will be given much more attention in the future.

As this fabric shows such a wide variation from that noticed on the same construction finished in other ways, it may be well to state something regarding the

PROCESS OF MERCERIZATION,

for this is the means whereby the results are produced. It may not be generally known, but the process of mercerization does not always produce the luster which usually designates the process. The change in the cotton fibre when mercerized under tension is to make it more or less like a small glass rod, which reflects light to a greater or less degree, depending on the twist in the yarn and the method of handling. Cotton fibre in the ordinary cloth or in the raw state is a rather flat twisted tube, with somewhat corrugated edges.

That there is a widely different result in mercerization when yarn or cloth is under tension is shown by the fact that the process was originally used to a great extent for shrinking cloth, thereby giving a much closer count than when woven, but under this method, when allowed to shrink, no luster is imparted to the fibre. The above is the principle which is employed in the cloth considered, but the application is somewhat different than when first used. It will be noted that the threads in the cloth appear straight in some stripes, and have a crinkled effect in others. The threads in the straight stripes are the ones where mercerization has taken place, and the cloth has been allowed to shrink in these spaces, and this forces the rest of the fabric to crinkle, giving the effect noted.

The

PROCESS IS ACCOMPLISHED

through the use of the printing machine, but as the pattern is simple, no description is required, excepting that the change takes place in stripes of various widths in the cloth. There are other problems which are of much interest in the finishing of this cloth, and while they are of benefit to the finisher, they are of much more value to the firm having the goods finished. It will be noted that there are 56 picks per inch in the grey cloth, and 66 picks per inch in the finished cloth, a net loss in yardage by shrinking of 18 per cent. This is the loss as shown by the picks in the cloth, but does not include the losses in finishing, which naturally take place. As a general thing, the finisher charges two cents per yard for this class of work, with a working loss of 25 per cent in the yardage delivered. In actual practice, the total loss to some converters has been 21 per cent, although, naturally, the patterns employed will vary the loss somewhat, as the heavier the mercerization the larger the loss in shrinkage.

It is very evident that a much different situation exists regarding these fabrics than there does on

many other lines, for a converter will receive 100 per cent or more than this amount of the yardage shipped, so on very many cloths there is no actual loss in yardage, and there is many times a slight gain received, and this helps to partially cover the finishing charges.

On some fabrics, the

ACTUAL DELIVERIES

are from 103 to 105 per cent of the yardage delivered to the finisher, the amount varying according to the cloth construction and other details. It will be noted that the increased cost to the converter, because of the method of finishing, is about 1½ cents per yard. This is in addition to the regular finishing charges of 2 cents per yard.

There is one reason why this process is not used to a larger extent, and this is because the cloth will stretch somewhat, although it does not do this enough to render the process of no value, but it would be better if this stretch could be eliminated, although, of course, there is the added objection of the higher price because of the loss in finishing. The process as employed affects the filling as well as the warp yarn, as can be noted from the cloth width in the grey and finished states or from the cloth counts. Most of the fabrics are sold in the white or bleached state, although a certain portion of the lines are dyed various colors. The

FABRIC ANALYZED

is lighter in weight, and has a somewhat lower count than many of the cloths now being sold. Sometimes a retail price of 25 cents per yard is charged for the cloth which has only a very little different construction than that considered, and the jobbing price is then about 16 cents a yard, with a converter's price of about 14 cents. Certain of the warp threads are made heavier in size because of the process employed, and the threads tested in size should be the ones which crinkle, rather than the ones which lie straight in the cloth.

That the various methods of mercerization are largely on the increase can be confirmed by almost any finisher of the better kinds of cloth. Recently, the use has been increased by being applied to voile fabrics, although this is not generally known outside of a comparatively few sell-

PATTERN.

50/1 Am. combed warp $\frac{2}{20}$ 2,796 $\frac{2}{20}$ = 2,876 total ends.
60/1 Am. combed filling. 56 picks.
35 reed, 40½" width in reed, 38" grey width, 30⅝" finished width.
74 × 56 grey count; 93 × 66 finished count.

YARNS.

	Cotton,	Labor, waste, etc.		
50/1 Am. combed, 1¼" sta.; 10 hank dou. rov.,	24c.	14½c.	=	38½c.
60/1 Am combed, 1¼" sta.; 14 hank dou. rov.,	24c.	15¾c.	=	39¾c.

COST.

2,876 ends 50/1 Am. combed + 5% take-up	= .0721 @ 38½c. =	$ .0278
56 picks 60/1 Am. combed	= .0450 @ 39¾c. =	.0179
Weaving		.0030
Expenses		.0063
		$ .0550
Selling		.0011
Mill cost		$ .0561
Converters purchasing price (about)		$ .0600
Converters net cost of cloth allowing 21% shrinkage		.0759
Finishing and mercerizing		.0200
Converters cost		$ .0959
Converters selling price (about)		$ .1100
Jobbers selling price (about)		.1250
Retailers selling price		.1900

Yards per pound, 8.53 grey.
Plain weave.

ers. This process applied to voiles gives a rounder yarn, and a much clearer looking cloth, which is highly desirable on these fabrics. Crepes are also sometimes treated in this manner, and it gives an added appearance and an

INCREASED VALUE

to the materials. It gives a much different appearance than when a crepe is made by hot water shrinking. Even fabrics made of ordinary print cloth carded yarn are being treated in this manner, and the results produced many times warrant the extra expenditures. Only a few years ago it was believed that the process was of little value, except on the better yarns and on the more expensive cloths, but due to large use and reduction in the cost of finishing, many of the cheaper fabrics are now being treated in this manner, and it is probable that much more use will be noted in the future.

The finished yards per pound are likely to be about 7¼ to 7½. It will be noticed that this is heavier than the grey yardage. Many fabrics are lighter when finished than when woven, and sometimes sizing material is added to bring the weight to about that which the grey cloth had previously been. To obtain the weights of yarn and the grey yards per pound before finishing the process is as follows:

2,876 ends $\div$ (50/1 $\times$ 840) = .0685, warp weight without take-up.
5% take-up in weaving.
.0685 $\div$ .95 = .0721, total warp weight per yard of cloth.

$$\frac{56 \text{ picks} \times 40\tfrac{1}{2}'' \text{ width in reed} \times 36''}{36''} = 2{,}268$$

yards of filling per yard of cloth.
2,268 $\div$ (60/1 $\times$ 840) = .0450, total filling weight per yard of cloth.
.0721 + .0450 = .1171, total weight per yard.
1.0000 $\div$ .1171 = 8.54 yards per pound (grey).

JACQUARD WAISTING

The class of fabrics under consideration has a large sale and are used not only for waists, but also for many other purposes. The ideas used in constructing these lines vary from year to year as fashion changes, but the yarns used do not differ widely in size nor does the cloth weight change much. Most of the various grades weigh between five and six yards per pound, but the warp and filling count may be widely different. The idea used in this cloth is a good one, and is adopted at various times for bringing out effects on other fabrics beside waistings. No large use has been made of it for some years, and it is very likely to be in demand within a comparatively short time. The whole ground effect is produced by having one light thread and then one heavy thread throughout the warp. While this cloth is made with two ends of yarn in place of a heavy one, the result is the same as if a single heavy end were used.

By this process of drawing-in ends, the woven result is given a sort of ribbed appearance, this effect being made because the heavy ends are all raised together, making a high place in the cloth, whereas when the light ends are raised practically no rib is made.

THE PATTERN

is produced on a jacquard machine, and is made wholly by raising the various heavy ends where desired. To make the cloth as firm as possible, the weave of the light ends is changed where the pattern is woven to a plain weave on the back of the cloth. This is purely a practical idea applied to a cloth to produce a better result. If this was not done, the ends where the pattern is woven would slip together, leaving a rather loose place in the fabric and spoiling the effect. Such practical applications show that experience has taught the maker of such fabrics some lessons which might be well absorbed by others, for we have seen similar cloths which would allow of much improvement along this line.

In making patterns for fabrics of this character, it is well to bear in mind that bad streaks are easily produced either in the warp or filling, which are likely to spoil the sale. If drop wires are used in weaving, any

very unequal spacing of figures is liable to make some threads with a small take-up, and for this reason, create endless trouble, unless the pattern is changed.

The yarn which forms the figure is

MERCERIZED BEFORE WEAVING,

because tension enough to give satisfactory results would break the lighter yarn in the warp. The yarns are used in the grey state, and the fabric is bleached and finished, when woven, practically the same as any ordinary grey fabric. As a usual thing, this class of cloths is not a very good weaving proposition, for the warp is reeded two heddles or mail-eyes to a dent, and this gives three ends per dent, one a heavy end and one a comparatively light end and the heavy end will rub the light end, causing trouble in some instances. The construction and yarns used have a great deal to do with the amount of trouble caused, although no unusual weaving condition should be noted in the cloth we have analyzed, for the count is low and the yarns should be able to stand any chafing which would occur. It is when a two-ply end, which sizes from 10-2 to 20-2, is woven in the same dent with rather fine single yarn and a rather fine reed that the percentage of production falls down and deliveries are not made on time. A large amount of seconds are also likely, and this eliminates a certain portion of the possible profits. This identical pattern could be made on various jacquard machines, but it is probable that it was made on a 600-machine, which was tied up in the comber board five inches wide, giving a possible count in the reed of about 120 per inch. We have assumed that the mercerized yarn was drawn in two-ply, and this makes a smaller number of harnesses used. As there are 286 ends used in each repeat, it gives 314 hooks or harnesses to cast out:

600 — 286 = 314 cast out.

As a 600-machine is built in rows of 12, this makes 26 rows, and 2 hooks cast out, or about 13 rows in each half-machine. A good method to use in casting out is as follows:

CAST OUT ROWS.

3, 4, 7, 8, 11, 12, 15, 16, 19, 20, 23, 24, 25, 28, 29, 32, 33, 36, 37, 40, 41, 44, 45, 48, 49, 50, and last two hooks in row 47.

In this cloth a rather

UNUSUAL CONDITION

exists, for there are exactly 6 repeats of the pattern:

29 reed × 30″ reed width = 870 total dents.
870 — 12 selvages = 858 cloth dents.
858 ÷ 143 dents in a repeat = 6 repeats.

Assuming that the loom is tied up for a 40-inch reed space, which many of them are, this would give 8 repeats in the harness:

600 ÷ 120 per inch = 5″ repeat.
40″ ÷ 5 = 8 repeats of tie-up.

Under the above conditions there would be exactly two sections of harnesses with no ends weaving, one section on each side of the loom. The warp would then be drawn, starting on the first hook in room No. 1 and section No. 2, and would finish on hook No. 10 in row No. 47 and section No. 7. To make the reed width and the harness width the same, a different number of ends should have been used:

29 reed ÷ 5″ tie-up = 145 dents.

As 143 dents were used, a stretch of two dents in 5 inches, is noted, or in the whole cloth width a stretch of 12 dents, or about 2-5 of an inch. This will cause no trouble in this cloth, for it is a comparatively small amount, and the harness width is wider than

THE REED WIDTH,

which helps in the matter, but the policy is a bad one to adopt unless care is used. To obtain the correct count in the cloth and use a certain ground weave sometimes makes a stretch between harness and reed necessary, but the amount should be as small as possible, as it causes hard wear through rubbing on the edges of the cloth, sometimes making a cloth a poor running one when it should be a good one. As all the heavy yarn is raised on one pick and all the

light yarn on the next, a certain strain on the loom results, which should be eliminated as much as possible so as not to produce streaky cloth.

Because of the low count, somewhat over 30 per inch on the ends which produce the figure, the effects obtained are rather crude in comparison with many of the finer woven fabrics. A small change where the count is low sometimes results in a much better looking pattern. The take-up in weaving on the 60-2 is quite large, for no high tension is used, so as to accentuate the effect desired. In many of these kinds of fabrics, Egyptian

production per loom is comparatively large, due to the small number of picks per inch.

In finishing, the fabric does not shrink much in width and

IS PULLED SLIGHTLY

in length. The amount of stretch always depends on the construction of the cloth, and the amount gained might be a different one from two mills producing the identical cloth through operating warps at different tensions. The cotton stock sometimes makes a difference, because if a yarn is weak it will not run satisfactorily

PATTERN.

30/1 Am. combed grey............	$\frac{2}{12}$	1		$\frac{2}{12}$	=	906
60/2 Eg. combed mercerized........			$\frac{2}{1}$		=	1,716
		$\underbrace{}_{858\times}$				2,622 total ends.

30/1 Am. combed filling; 60 picks.
29 reed; 30" width in reed, 28" grey width, 27¾" finished width; 93 × 60 grey count; 94 × 58 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting, merceriz-ing, etc.		
30/1 Am. combed, 1⅛" sta.; 6 hank dou. rov.,	16c.	8c,		=	24c.
60/2 Eg. combed, 1⅜" sta.; 12 hank dou. rov.,	26c.	17c.	12c.	=	55c.
30/1 Am. combed, 1⅛" sta.; 7 hank dou. rov.,	16c.	8¼c.		=	24¼c.

COST.

906 ends 30/1 Am. combed...............+ 5% take-up	= .0379	@ 24c.	=	$ .0091
1,716 ends 60/2 Eg. combed...............+ 17% take-up	= .0820	@ 55c.	=	.0451
60 picks 30/1 Am. combed..............................	= .0714	@ 24¼c.	=	.0173
Weaving				.0127
Expenses				.0165
Selling				.0021
Mill or grey cost..				$ .1028
Price to converter (about)..................................				$ .1200
Finishing, bleaching, etc.				.0125
Price to retailer (about)..................................				.1650
Price to consumer				.2500

Yards per pound, 5.23 (grey).

cotton is used for the yarn which is mercerized, a better gloss being obtained in this manner. Another thing which helps in giving added sheen is to make the two-ply yarn of soft twist, which is most always done. Because yarn is made soft twist, it is almost always used in the two-ply form to give satisfactory strength to handle when mercerized in the yarn state, although much soft twist single yarn is used when cloth is mercerized in the piece. Jacquard looms are not operated so fast as dobby looms which make the same kind of cloth, but the

under high tension, and the use of drop-wires will also affect the result. No large amount of knowledge is necessary in making up designs for a cloth of this nature. To obtain the best effects, a little care is necessary, but the amount of sketching and painting is small, and little more time would be required to lay out this design than that on many complicated dobby patterns. To get a good cloth construction, which can be made and sold at a price to return a good profit, requires much more ability, and to produce and sell a satisfactory cloth

construction, similar to the one analyzed, largely overshadows the small ability required in fitting the design to cloth.

It is becoming a matter of the greatest importance to buyers to have men who can produce fabrics at a price, and a large share of responsibility has been taken from mills, especially those making what might be called the newer fabrics. At the mills the idea is simply worked out on the construction ordered. The cloth construction and price are of far more importance in the sale than the designs in the majority of instances, although naturally a satisfactory effect helps the sale on any cloth, and a poor design will sometimes kill a good idea. The aim should always be to obtain the best results. The weights are obtained as follows:

906 ends ÷ (840 × 30/1) = .0360, weight of 30/1 without take-up.
5% take-up in weaving.
.0360 ÷ .95 = .0379, weight of 30/1 with take-up.
1.716 ends ÷ (840 × 60/2) = .0681, weight of 60/2 without take-up.
17% take-up in weaving.
.0681 ÷ .83 = .0820, weight of 60/2 with take-up.

$$\frac{60 \text{ picks} \times 30'' \text{ reed width} \times 36''}{36''} = 1{,}800 \text{ yds.}$$

of filling per yard of cloth.
1,800 ÷ (840 × 30/1) = .0714, weight of filling.
.0379 + .0820 + .0714 = .1913, total weight per yard.
1.0000 ÷ .1913 = 5.23 yards per pound. (grey).

FANCY ALL-OVER LENO

In the selling of various fabrics there appears, with more or less frequency, a cloth on which the price is excessive. Possibly such occurrences are more numerous in the sale of silk fabrics than they are with those of other materials, but, nevertheless, they do occur in all lines. That such prices are justified may be the contention of many sellers, and their argument is well taken, if novelty and newness be considered, but consumers must expect to obtain but little actual relative value when comparison is made with other fabrics. Instead of paying for value, they pay largely for style, and many purchasers are willing that such should be the case.

There is one glaring injustice in the method as at present in force, and this is regarding the prices received by the various sellers. It is a fact that many mills, and some converters, are continually attempting to produce something different, either in regard to patterns or constructions, and that they bring successful results is amply proven by an examination of some of the lines shown to-day, but inasmuch as most mills are not in touch with selling to the retailer or consumer and have no way in which to gauge the possibilities of any cloth, they invariably lose all or a large part of the benefits which should come to them for their ability in originality. On

THE OTHER EXTREME,

the retailer stands between consumer and seller, and acts as a bear to sellers' prices and a bull to the prices which the consumer must pay. In this manner it is possible for him to obtain excessively high prices on a fabric which shows novelty and style, and on which the other sellers have obtained but comparatively small returns. This exerts a double effect, for it causes a small distribution with a high cost of production and effectually blocks the way for a mill to obtain the returns which should be received from a large sale and a lowering of production cost, and the other effect is that which consumers obtain regarding excessive mill profits. In other words, it makes a fabric which might be a comparatively large seller with generous profits to all, a very small seller with the retailer obtaining the large profits, and profits which are not deserved through any excess of ability on his part.

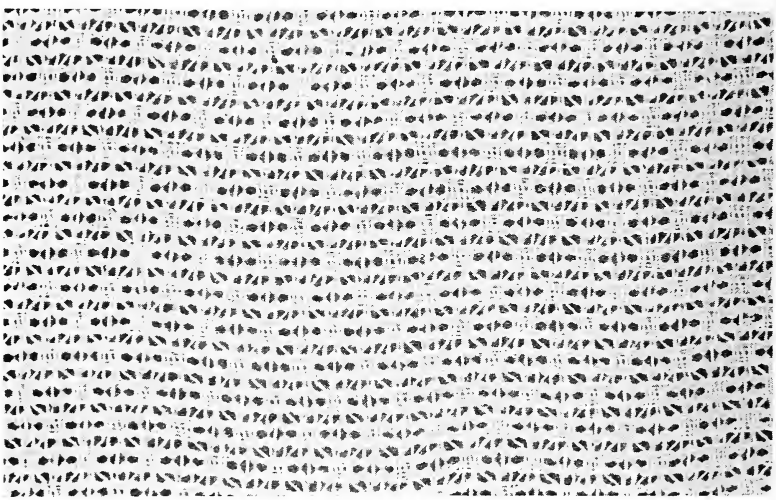
Of course, this statement does not mean that the retailer should not obtain more than his ordinary profit on a cloth which shows a novelty character, for this is not true, as he is taking a larger chance on such materials, but it does mean that where a few cents added to the maker's price will give him highly satisfactory

returns, such an addition will make an insignificant appearance on the price to the consumers. Take the cloth we are considering as an illustration of this statement. One cent per yard to a maker will yield a profit per loom per week of about $3, because production is high, due to the small number of picks per inch, even with a slow loom speed and a low percentage of production. Thus it will be seen that the profit per year at a net profit of one cent per yard will be about $150, and with a total valuation of $1,000 per loom, which is high, the net profit would be about 15 per cent, an entirely

SATISFACTORY RETURN.

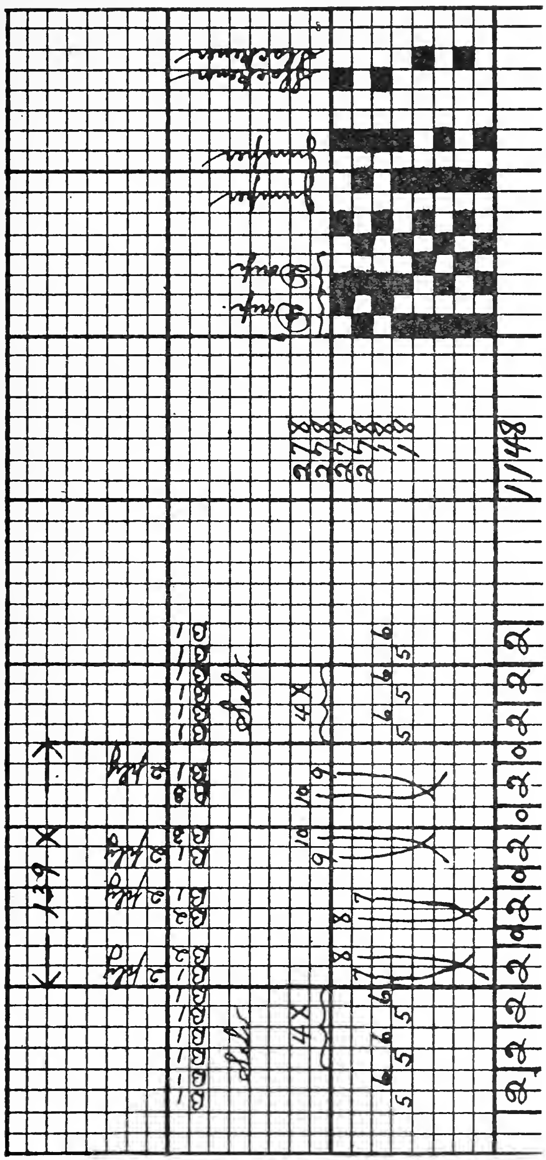
We ask in all fairness to a mill whether or not such a return should be realized, especially when the price of this cloth at retail is $1.25 per yard. It can be stated as a fact that many times fabrics of high novelty character are sold by mills at lower comparative prices than some of the plainer lines. This may seem strange, but it is done through the method of selling, for many times a blanket order is placed, and in this order will sometimes be novelties which never should have been included, and which mills should have refused to make.

We have seen leno stripes sold in the above manner at 5¼ cents per yard which no mill could make for less than 9 cents, and which some of the successive sellers would place in a higher classification, thereby deliberately deceiving the mill regarding the retail prices and on which the mill should have received a higher price. Some sellers think such practices are justified and that mills are at fault when it is done, but this does not appear entirely true, for sellers often say the good patterns carry along the others, while the facts are that higher prices are charged for the better ideas.



Fancy All-Over Leno.

The cloth we have analyzed is one of such cases. Whether the retailer is obtaining an enormous profit or whether some previous seller is obtaining large returns is not known, but it is practically certain that no mill could receive a high enough price to justify such a retail price, namely, $1.25 a yard. Of course, the material is an all-over leno, but there is noth-



Drawing-in Draft.

ing about the manufacturing of it which any fancy mill with wide enough looms could not accomplish. If the leno yarn were of fine character and liable to cause trouble, it would be a different matter, but the yarn used is strong and little breakage should occur.

The cloth count is also low and aids in the weaving operation, while there are few picks per inch, giving a large yardage per loom with a corresponding decrease in production cost. We have seen large quantities of all-over lenos produced during the past few years, and sold at about 17 cents a yard, when the actual cost of production was as high or higher than this cloth, and the cloth was also a bad weaver with a large number of seconds, and what is more, the mills were very glad to obtain the orders, even under such conditions, for, as previously stated, the large production returned satisfactory profits.

Inasmuch as this fabric is somewhat different from those usually seen, it may be well to give more information regarding the making. To produce a leno

A DIFFERENT HARNESS

is used. This consists of a standard harness with heddles placed on it, similar to those ordinarily used, but with extra heddle eyes. In addition to this harness is another which contains no heddles, but which has what are called doups, or loose yarn, which are attached to the base of this extra harness and which pass through the eyes of the standard harness. This arrangement allows free play to the doup harness, but another arrangement is made whereby, when the standard harness is raised, the doup is also raised. The crossing or douping end is not drawn through the heddle eye, but through the doup loop. An examination of draft and chain will show the process and the method in which the various harnesses operate. Instead of one doup, there are two necessary in this cloth to produce the pattern, because while some threads are changing, others are remaining either up or down. It will be noted that on the chain-draft we have used two harnesses alike, No. 7 and No. 9. This is more for convenience than for any other reason, and it may also help in operation. Because of the different weave it is necessary to have two beams for the crossing yarns.

It will be noticed that the crossing yarn is raised continually, while the ground yarn, which is drawn in two-ply, is continually depressed, a condition which in any other material would not produce a fabric at all, but which in this and similar lines makes a satisfactory cloth. In the weaving operation, the crossing ends have a much larger take-up than do the ground ends. This is shown in the analysis, for the crossing threads take up 38 per cent, while the ground yarn takes up but 11 per cent. In making fabrics of this nature it is customary to leave empty dents in the reed in planning the cloth. This gives a chance for the leno to spread and gives better results in certain instances. We have done this in our layout and the empty dents are clearly designated. When a fine count ground is used with leno stripes it is sometimes necessary to skip not one but a number of dents to make the right effect, and it is also sometimes necessary to take out dents in the reed to allow room for the various ends to operate, for they

ARE OFTENTIMES CROWDED,

and the heavy crossing end, which is many times used, will break the fine ground threads, causing a large amount of trouble. Much care has to be exercised in making any kind of leno cloth, for the breaking of a doup through wear, or the breaking of one of the ends in weaving, will produce a bad place in the fabric, much worse than would occur in the ordinary cloths. When the crossing ends are in a crossed position, or in other words, when both doup and standard harnesses are raised, it is necessary to have an arrangement whereby extra crossing yarn is let off. This is necessary to ensure satisfactory weaving conditions, for the crossing end passes under the ground threads and more yarn length is needed if no

breakages occur. When the crossing end returns, the yarn is pulled back. Where the slackener is marked in the chain shows the pick when each operates. Usually the head is adapted so it can operate a whip roll arrangement to give the extra yarn when the threads cross. The jumper lifts the harnesses No. 7 and No. 9 half way and is of much service in straightening out the doups on the ordinary double lift dobby loom. The weights of the yarns used and the yards per pound are obtained as follows:

1,148 ends ÷ (40/3 × 840) = .1025, ground warp weight without take-up.
11% take-up in weaving.
.1025 ÷ .89 = .1152, total ground warp weight per yard.
2.8 ends ÷ (40/3 × 840) = .0248, crossing warp weight without take-up.
38% take-up in weaving.
.0248 ÷ .62 = .0400, total crossing warp weight both on beam 2 and beam 3.

$$\frac{47'' \text{ width in reed} \times 30 \text{ picks per inch} \times 36''}{36''} =$$

1,410 yards of filling per yard.
1,410 ÷ (40/3 × 840) = .1259, total weight of filling per yard.
.1152 + .0400 + .0400 + .1259 = .3211, total weight per yard.
1.0000 ÷ .3211 = 3.11 yards per pound.

PATTERN.

40/3 Am. combed.....	18	$\frac{2}{1}$		$\frac{2}{2}$		$\frac{2}{1}$	18	=	1,148 beam 1.
40/3 Am. combed.....			2					=	278 beam 2.
40/3 Am. combed.....					2			=	278 beam 3.
		139×							1,704 total ends.

40/3 Am. combed filling. 30 picks.
24 reed, 47" width in reed, 42" grey width, 42" finished width.
40 × 30 allover finished count.

YARN.

	Cotton.	Labor, waste, etc.	Twisting.		
40/3 Am. combed, 1⅛" sta.; 8 hank dou. rov., Warp and filling of same yarn.	20c.	10½c.	3c.	=	33½c.

COST.

1,148 ends 40/3 Am. combed...............+ 11% take-up	= .1152	@	33½c.	=	$ .0386
278 ends 40/3 Am. combed...............+ 38% take-up	= .0400	@	33½c.	=	.0134
278 ends 40/3 Am. combed...............+ 38% take-up	= .0400	@	33½c.	=	.0134
30 picks 40/3 Am. combed....................................	= .1259	@	33½c.	=	.0422
Weaving					.0389
Expenses					.0088
					$ .1553
Selling					.0031
Mill cost					$ .1584

Finishing, etc.
Yards per pound, 3.11 grey.
Retail price, $1.25 per yard.

COTTON SURF SERGE

This fabric is one of a variety which we have not considered to any great extent previously and inasmuch as there are rather interesting features regarding the cloth and its finishing, it may be well to give an analysis of a typical construction. As a general thing, these cloths are used for linings and similar uses, although they are also used for dresses and many other purposes, and the fabric in question was sold for the making of bathing suits, although we should imagine the utility would be limited in this direction for various reasons.

While this identical cloth has a twill weave, the construction is very similar to that of many fine satins, that is, the same yarns are used and the cloth count is similar, the weaves alone making the different appearance when woven. Twill and satin weaves woven on the same number of harnesses are practically identical, because a satin weave is nothing more or less than a twill weave rearranged.

The first difference noted between such a fabric as the one analyzed and most of the ordinary cloths is one of construction. In a plain cloth

IT IS NOT NECESSARY

to have nearly as high a count as it is with a weave such as has been used. When a cloth is woven, the

number of threads and picks per inch and also the weave, together with the yarn size, regulate the cloth firmness, that is, a plain weave contains two warp threads in a repeat, but the filling yarn crosses between each thread, making it necessary to have a certain amount of space between each thread to allow for this crossing, while in a cloth where the weave does not change on every thread, fewer spaces for crossings are necessary and, therefore, to make the cloth as firm as with plain weave, a larger number of threads or picks are necessary, if yarn sizes be identical in each fabric. Because of the fine yarn sizes and the weave used this cloth has a high count, namely, 100 x 172 finished. In the first place it may be stated that a good deal of cloth such as that considered is made on cam looms and the problem of manufacture is somewhat similar to that noted when plain cloths are made.

This material is a quality product, for the yarns are well made, the weaving is even, and the result when finished is very satisfactory. The yarn sizes are no finer than many of the up-to-date mills make continually and in large quantities, but sometimes in such a cloth as this better cotton would be used than if the yarn were to be used in some other kind of cloth. This is done because there is an excessive amount of friction on the yarn due to the high number of picks per inch and resulting slow weaving, and unless good yarn is used loom production will be unsatisfactory. The large amount of filling on the surface makes it necessary for that yarn to be even, and to obtain a soft fabric the twist in the filling is likely to be less than if used in other cloths. Comparatively few cloths are produced with as high a count as this fabric. The take-up in weaving is very small and in most cases the filling yarn shows a greater shrinkage than the warp.

There is one item regarding this sort of cloth

WHICH AFFECTS ITS COST

greatly, and this is the high number of picks per inch. When a mill is making voiles, poplins, shirtings, or some other classes of goods the large production in yards per loom or per weaver makes the weaving and expense costs comparatively low, and while much economy is possible, it will affect the ultimate cost but little, yet on such a fabric as that considered the labor cost is high, due to the small production, and there is a great chance for economy in producing, with a corresponding reduction in cloth cost. Another thing which has to be considered in this same direction is the obtaining of profits.

With a loom weaving voiles or similar low pick cloth, a profit of one-half cent a yard might return satisfactory dividends because of large loom production, but when the picks per inch are as high as in this cloth with the resulting small yardage, a much greater return a yard is necessary if the same ultimate profit be secured from operation. It is entirely possible that a part of the recent partial operation in fine and fancy mills has been due to the kinds of cloth made, that is, the cloths sold have been largely voiles and poplins, both made with a small number of picks per inch, and while the yardage produced may not be much smaller than usual it has been insufficient to give mills all they desired in the way of orders. A return to fabrics with a larger number of picks would, without doubt, aid much in making a better condition in fine and fancy goods manufacture.

What the above

REFERENCE TO PROFITS MEANS

will perhaps be clearer by stating that a net profit of 2 cents a yard on such a fabric as this will only return a profit of about $1.55 per week, or about $80 per year per loom. Assuming that a loom valuation, or cost of a mill per loom, be about $600, and this is conservative, the profits per year would only amount to about 13 per cent, surely not an excessive amount in comparison to what other sellers of cloth many times receive.

As stated previously, there are interesting features regarding the finishing of this cloth. Probably most of such material i dyed a black shade, though this is not necessary, except-

ing when used for certain purposes. In many lines a full range of colors is sold.

There is, however, one thing which is noted as soon as the cloth is seen, and this is the luster, the face of the cloth having a sheen which the back does not. In finishing such fabrics it is customary to singe off all the cotton fibres which project and this gives a rather smooth surface. Of course sizing materials are used, the ingredients depending on the results desired when finished, but in addition a calendering process is employed.

Sometimes a fabric is finished double fold, thus giving the face a gloss which the back does not have, and sometimes an extra fabric is used as a back cloth and the material is run full width. In this case the top roll does the pressing. There is in this fabric a novel feature which is not oftentimes used and this can be seen by examining carefully with a magnifying glass. On the fabric there appears innumerable fine lines which run in opposite direction to the twill weave of the cloth. This is done by having the pressing roll milled in a manner to produce the effect.

Though it may not be generally known,

IT IS A FACT

that the reflection of light produces a gloss and this reflection is made possible by pressing lines into the finished fabric. Some have been inclined to believe in the past that the excessive luster which some cloths had was either made through the use of mohair or through sizing and pressing, but in many instances it is the method of pressing rather than the pressing alone which has produced results such as those seen on the cloth analyzed. Naturally any pressing or milling on a cotton fabric will disappear when the material is washed, and will also decline in luster through use without washing, so such a finish is not permanent, although the result noted when sold approaches very many all-silk fabrics. One other reason which tends to make prices closer on various lines of satins is that orders are for quite large amounts, possibly not so large as for plain constructions, but much larger than for fancies. Fewer colors are usually required when finished and this tends to keep finishing costs rather low.

The cost of production places this cloth in a much higher retail price than is noted on other cotton fabrics which do not have a fancy weave or a novelty construction. The material used in this fabric costs about 47 per cent of the total amount, leaving 53 per cent for labor and expenses, while in very many other fine cloths the material constitutes about 60 per cent of the cost, with labor forming about 40 per cent. Some kinds of coarse fabrics have labor costs as low as 15 per cent of the total, and the above statement shows how important carefulness in management is in the producing of such cloths. To have the pressing or milling give as good results as possible, the cloth should not have a great amount of tension in the width when being processed. This accounts for the larger amount of shrinkage in cloth width, when compared with other cloths in finishing.

Very many fabrics of this nature

HAVE A WARP COUNT

of 96, and the number of picks are varied according to the yarn sizes and the weave used. Sometimes the number of picks is regulated to an extent by the price, and if a buyer needs to get inside of a certain limit, the reduction is usually made through a lowering of the picks per inch. There is a certain amount of stretch when the cloth is finished, but it is not so large as on some varieties of fine plain material. To obtain the yards per pound and the weights of the yarns used the process is as follows:

3.640 ends ÷ (60/1 × 840) = .0722, weight of warp without take-up.
3% take-up in weaving.
.0722 ÷ .97 = .0744, total weight of warp per yard.

$$\frac{176 \text{ picks} \times 40'' \text{ width in reed} \times 36''}{36''} = 7{,}040$$

yards of filling per yard of cloth.
7,040 ÷ (60/1 × 840) = .1397, weight of filling per yard.
0744 + .1397 = .2141, total weight per yard.
1.0000 ÷ .2141 = 4.67 yards per lb. (grey).

Some mills would not make two sizes of roving if they were produc-

ing 60-1 warp and 60-1 filling, but would make both yarns from one size of roving. This method makes a shorter draft possible for the warp, and increases the cost for warp while reducing it for filling. If 12 hank be used for both yarns, it is all right for warp but makes too large a draft for filling if the best results be desired.

Where quality filling is necessary it probably is better to use a finer roving for filling than for warp, although there are cloths where the making of the same size yarns would give entirely satisfactory results and might aid in reducing the cost beside making a smaller number of roving sizes in process. Results desired will govern the methods employed to a greater or less extent, and the other cloths being made may also have more or less influence on the policy adopted.

PATTERN.

60/1 Am. combed warp $\frac{4}{10}$ 3,560 $\frac{4}{10}$ = 3,640 ends.
60/1 Am. combed filling. 176 picks.
45 reed; 40" width in reed, 38½" grey width, 36" finished width.
100 × 172 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
60/1 Am. combed warp, 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.	=	40½c.
60/1 Am. combed filling, 1⅜" sta.; 14 hank dou. rov.,	24c.	15¾c.	=	39¾c.

COST.

3,640 ends 60/1 Am. combed .... + 3% take-up = .0744 @ 40½c. =	$ .0301
176 picks 60/1 Am. combed .... = .1397 @ 39¾c. =	.0555
Weaving	.0226
Expenses	.0258
	$ .1340
Selling	.0027
Mill cost	$ .1367
Mill selling price (about)	$ .1550
Finishing, dyeing, etc.	.0150
Converter's cost	$ .1700
Converter's selling price (about)	$ .2000
Jobber's selling price (about)	.2400
Retail price	.3500

Yards per pound, 4.67 grey.

Weave $\frac{1}{4}$ twill.

SILK MIXTURE WAVE CREPE

There are a number of interesting features in the fabric which is being considered. These cloths are used for a number of purposes, but the largest distribution is made for dress materials. Usually such materials are produced in cotton mills and are sold at comparatively low prices when the detail necessary in making is considered; also, the fact that the warp is made entirely of silk yarn which creates more or less trouble until operatives become used to handling the silk yarn. There is a more or less regular demand for fabrics of this character, but it will be noted that the retailer was disposing of quite a stock of goods at 22 cents per yard, a price which is unusually low and which indicates that some previous seller offered the cloth at a decided loss. Such material is often sold through a jobber, and sometimes from the converting jobber direct to the retailer, and naturally prices will vary somewhat, but this fabric cannot be sold at 22 cents per yard and offer any chance of profits to the various sellers.

Manufacturers seldom make such fabrics unless at

A GREATER OR LESS PROFIT,

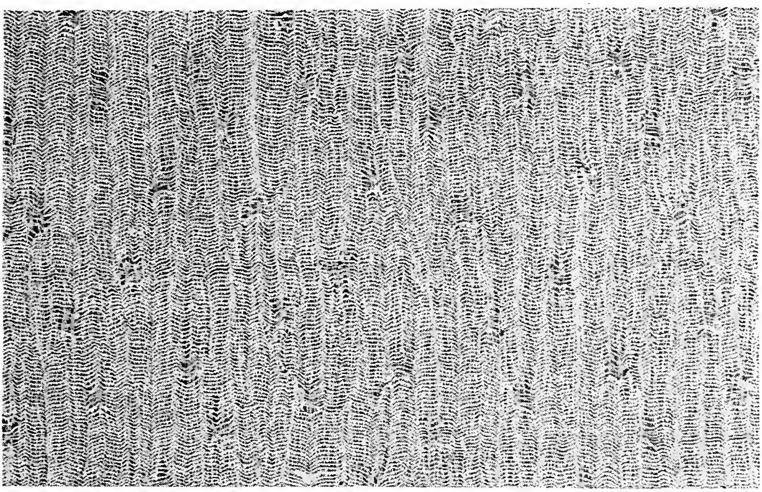
for the goods are made on contract and competition is not very keen, so it is unlikely that the mill selling price was much below 15½ cents, and it probably was higher than this. Then added to this price is the charge

for finishing and the profits which usually go to the sellers of a high-class novelty fabric. Under the circumstances it is evident that some converter held a surplus stock which was disposed of at a sacrifice, making a low retail price possible. It is probably true that silk and cottons such as these have been affected more or less by the lack of interest in other silk and cotton fabrics which were killed by certain converters and converting jobbers a year ago by cutting the cloth construction to a point where little actual value remained.

probably most mills using about 22-24. We have used 180,000 yards

AS THE STANDARD

in obtaining the weights, but this is not the theoretical yardage, and is used in this size to allow a certain amount of protection to cloth maker for variation in silk size. This cloth is called a serpentine crepe. Consumers would hardly recognize the similarity to many ordinary crepe de chines, but the fact is they are very similar, sometimes being made of identical yarns and with the same



Silk Mixture Wave Crepe.

The sales of such lines at low prices indicate how hard some sellers were pinched, for retailers are to-day offering certain cloths for 8½ cents in a finished and dyed state which cost the mill from 13 to 14 cents to produce in the grey state, and very many others sold at retail the same cloths at 12½ cents per yard. It is believed that the development in silk and cotton has made certain converters much more conservative than they have previously been. Italian silk is ordinarily used in making cloth of this character, and it is seldom finer than 18-20 and usually coarser than this number,

cloth construction. The main difference can be stated as being one of weaving and twists in the yarn, a serpentine crepe is made from filling yarn of one direction of twist, and is woven on a regular loom, while a crepe de chine is made with yarn of two twists and is woven on a box loom. Sometimes two picks of one twist are placed in the cloth and then two picks of the reverse twist are woven, and sometimes other arrangements are made.

THE DIFFERENCE

in the finished cloths is expressed by

saying that the crepe de chine has a more or less regular crepy look, while the serpentine crepe has quite a heavy wavy appearance. This crepy or wavy appearance is obtained through the use of hard twist filling in both instances. Sometimes single yarns are used and in other cases yarn of two-ply character is employed.

The actual filling count is rather low, but is high enough to prevent bad slipping. Two methods are employed in making hard twist two-ply yarn for use in these cloths. In one process the twisting is done on a spinning frame onto enameled bobbins, and all that is necessary to insure satisfactory weaving is to steam the bobbins. This is naturally the cheapest method, but when yarn is twisted on a regular twister, the bobbins are not usable in a shuttle, so the yarn much be spooled, ball warped, sized, and quilled before it can be used in weaving. When the yarn is sized in the second process, and this must be done to stop kinks in the yarn, it is not necessary to steam to set the twist.

The single hard twist yarn is, of course, handled by the first method. The standard of twist used in making these yarns will vary greatly, due to different conditions of making and somewhat to the cotton used. A smooth long cotton

WILL REQUIRE LESS TWIST

than shorter fibres, and the standard will usually vary from 6 to 8, but instances have been noted where as high a standard as 10 was used. Most yarns have standards of from 7 to 7½. What this hard twist does can be readily noted when the grey cloth width and the finished width are compared. The original width is about 32 inches, while the fabric finished is 24 inches. The hard twisted yarn will shrink readily when immersed in hot water, and this accounts for the appearance when sold and indicates how important the factor of yarn twist is in such cloths.

If a standard f 6 acts satisfactorily, it is a deliberate waste to use a higher standard, for it increases the cost of production quite rapidly, because the larger the amount of twist the smaller the production. Ordinarily, the labor cost of such yarn is about twice as high as it is on regular warp yarn. Some mills merely make the crepe through hot water or steam, but there are certain other finishers who use a mercerizing process to obtain the same results. There is an added attractiveness through mercerizing, but it is sometimes a question of getting the cloth as cheaply as possible, so this is not done, and it has also been true that some finishers or converters did not know the process was possible and never asked to have it applied.

Thes fabrics are made with jacquard patterns and also with dobby figures, but by far the

LARGEST PORTION IS MADE

with plain weaves. Of late, there has been a tendency to use heavy silk stripes for decorations, but it adds to the cost, and for this reason, is objectionable. Similar lines of fabrics have been sold for scarfings and have had a satisfactory distribution. There is one thing which has been true until recently regarding the making and selling of novelty silk and cotton fabrics, and this is that profits have invariably been large.

Up to a few years ago there were only a few mills which cared to use such material, not alone because they thought its use would create more or less trouble, but also because the making of such cloths upsets the mill organization. For a fancy mill to weave such fabrics it is necessary to keep spinning frames idle which have previously made warp yarn, and if silk filling be used, filling frames are idle. Naturally, the carrying charges are as large as if they were in operation, and this makes a high profit imperative, if the making be successful. Sometimes a mill can operate its excess of spinning on yarn for sale purposes, but inasmuch as no regular custom is held, prices for yarn under such conditions are not so high as they might be.

Certain instances are known where a mill sold yarn at a high price for a year or more, and to keep

THE WEAVING IN OPERATION,

accepted orders for silk novelties at

a price slightly above cost. Without doubt, the accepting of orders which continually keeps a novelty mill in balance is one of the most important, if not the most important, portion of the business. The taking of orders which upsets the organization is one of the fruitful sources of lack of profits and more money can be lost in this manner than can be made up through economical operation. The art of selling cloth has been responsible for some of the large successes in fancy cloth making, and the lack of it for some of the failures. It is believed that the importance of this ability is being forgotten by certain mills who are not considering the long future.

The sentiment has been expressed many times of late that anyone can dispose of cloth if the quality is right, and while this may appear true to an extent, it is also a fact that some sellers know nothing regarding manufacturing or the details thereof, and through this reason sell fabrics which might have been better unsold, as far as the mill was concerned. A seller should know what is best for his organization to make and strive to hold to such fabrics. If selling conditions make it imperative to sell other cloths, or if fashion takes a different trend, other orders should be taken to continue a proper balance in manufacturing.

Naturally, when orders are not in large volume, a seller must needs accept the ones which are offered, but much might be done

TO IMPROVE THE SITUATION

when selling conditions are normal. It will be noted that this fabric is rather light in weight, as most of such lines are, and also that the cotton forms over 75 per cent of the total cloth weight. The silk is woven in the gum and very little luster is seen on the cloth until it is finished. In finishing, some of the silk gum is removed, the amount depending on various conditions. To obtain the weights of the silk and cotton composing the cloth and the yards per pound, the process is as follows:

3,156 ends ÷ 180,000 yards = .0175, warp weight without take-up.
7% take-up in weaving operation.
.0175 ÷ .93 = .0188, warp weight per yard of woven cloth.

$$\frac{50 \text{ picks} \times 33\tfrac{1}{4}'' \text{ width in reed} \times 36}{36''} = 1{,}662.5$$

yards of filling per yard of cloth.
1,662.5 ÷ 23,000 yards = .0723, filling weight per yard of woven cloth.
.0188 + .0723 = .0911, total weight per yard.
1.0000 ÷ .0911 = 10.98 yards per pound.

Note that the yards per pound of the 60-2 hard twist is not 25,200, the yardage ordinarily seen, but 23,000 yards per pound, due to the contraction in hard-twisting.

PATTERN.

$$23/25 \text{ Italian silk} \quad \frac{4}{16} \quad 3{,}028 \quad \frac{4}{16} \quad = 3{,}156 \text{ total ends.}$$

60/2 Am. combed hard twist, 50 picks.
46 reed; 33¼" width in reed, 32" grey width, 24" finished width.
98 × 50 grey count, 131 × 49 finished count.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
60/2 Am. combed H. T., 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.	8c.	= $ .48½
23/25 Italian silk, 180,000 yards per lb. Ready on beams,				= 4.35

COST.

3,156 ends 23/25 Italian silk + 7% take-up = .0188 @ $4.35	= $ .0818
50 picks 60/2 Am. combed hard twist = .0723 @ .48½	= .0351
Weaving	.0142
Expenses	.0124
	$ .1435
Selling	.0029
Mill cost (about)	$ .1464
Price to converter (about)	$ .1550
Finishing, dyeing, etc.	.0250
Converter's selling price	.2000
Jobber's selling price	.2500
Retail selling price (usual)	.3500
Retail sale price (actual)	.2200

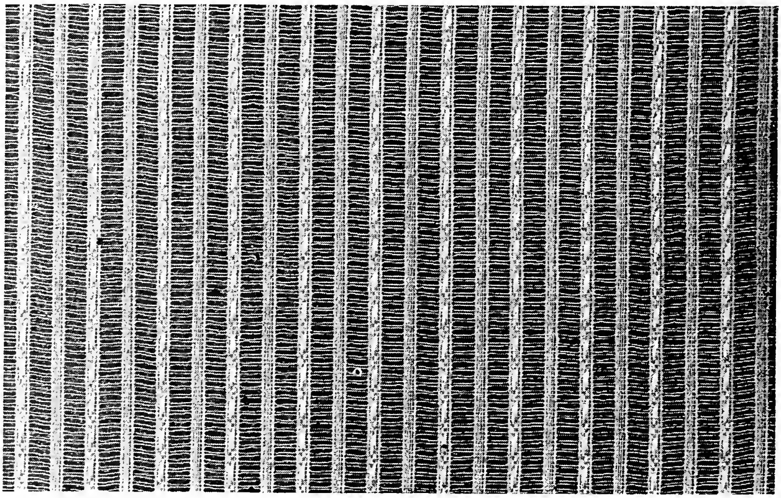
ARTIFICIAL SILK STRIPE OVERDRESS

This fabric is one which illustrates a number of ideas which are of interest to-day, not only in regard to the cloth construction used, but also in connection with its being an imported material. In the first place, it can be said that there should be more of the smaller mills producing fabrics of this character, or similar ones which are in style, and which show a good profit, although the orders are small. A good many mills, probably most of the small domestic ones, trail the large operatives, making similar patterns and competing, or attempting to, on prices. Of course, many times small mills sell their product in different channels and in smaller amounts, thereby receiving a

SOMEWHAT HIGHER PRICE,

and this is the only reason that they can continue in operation and make any money.

There is a great opportunity for small, well-fitted mills to produce just such cloths as we are considering, a field where competition is not so keen and where profits are comparatively large. A large mill cannot produce such fabrics in small enough quantity and if they could, the detail of so many orders would probably tie up a mill. A man of ability in a small plant can develop more or less originality in cloths, building up a trade which want quality fabrics, and are willing to pay for them. There is a legitimate place in manufacturing for a small mill, but it is not in attempting to produce styles which large plants are running, but rather in the making of exclusive fabrics and for an exclusive trade.



Artificial Silk Stripe Overdress.

Comparatively few of such fabrics are produced in domestic mills, but if the right methods were pursued, it is very likely that the 3 per cent of fabrics which are imported of the total domestic consumption would then be produced in domestic plants A large proportion of the cloth which is imported is not cloth which enters actively into domestic competition; that is, it fills a need which mills

here either cannot or do not supply. If mills were inclined to develop this trade, there would be practically none imported, for duties are so greatly in excess of necessity that foreign fabrics absolutely could not be sold in competition.

Probably the duty assessed on this cloth is as great or greater than the entire labor cost of producing, at least, in any sized quantities in domestic mills, and because of the yarns used and cloth construction, labor charges form a large portion of

THE TOTAL COST

of production. Naturally, a man operating a small mill and making exclusive fabrics needs to be familiar with the various mill processes and know how to obtain results in the best and most economical manner, and not only this, but he must be familiar with the selling end of the business and the styles which are likely to be used by an exclusive trade. It is admitted that men who could operate such a business are rather scarce, and the ones who are able are about all employed in larger business. In other words, there are not enough capable men for the good of the textile trade to-day, but the numbers of trained men are increasing, and sooner or later, more of the cloths which are now imported will be produced. The need for trained operatives is great, but the need for capable, trained and original managers is greater, and until experience and training produce a supply of such men, foreign cloths will continue to be imported, even with a duty twice as high as it is at present.

Take the cloth we are considering and note the ideas used. It has, in the first place, the general appearance of voile cloths, which are comparatively good sellers to-day, thereby bringing the highest rate of profit. It is made in such a manner that very little of the high-priced material which it contains is needed in producing, and it comprises a small amount of artificial silk, which gives it an exclusive appearance.

Many similar fabrics, with the exception of the silk stripes, are made in domestic mills, but it is doubted whether they return the profits which this cloth would. Possibly,

DOMESTIC FABRICS

are not made of quite so fine yarn, but for consumers little difference could be noted. It is the right introduction of silk, the right spacing of stripes, the difference from other fabrics which makes an exclusive material or style, and contrary to the idea of most people, both buyers and sellers, such difference consists more of small details than it does of any great radical difference. We have seen designs produced for a certain construction which were absolutely worthless, and we have seen the same designs produced on the same cloth construction which compelled admiration and produced sales.

Another illustration of the same results follows: On a certain shirting fabric much trouble resulted because of cloth quality and strength. Instead of using better and longer cotton, circumstances compelled the attempt to

USE SHORTER STOCK,

but along with this shorter stock was the use of a better arrangement of stripes in the pattern. Entirely different results were produced, and the improvement in cloth appearance was noticeable, the buyers being much pleased, although they did not know that the cloth was actually costing one-fourth of a cent less per yard to make and would not break so high as before. Probably the poor original appearance made buyers critical of all the items of interest in the cloth, while the better arrangement overbalanced any minor defects.

In a cloth such as the one considered it is necessary to have

A LENO EDGE

along each stripe, so as to keep the stripes in their correct positions, and to give a clear open space between. Because of the crossing which takes place on every pick, it is impossible to introduce but a comparatively few picks into the cloth. Just the right number of picks to use for such a fab-

ric as this can only be determined by experimentation. Too many picks will cause trouble in weaving, and the use of too few will allow much slipping, spoiling the general effect. When more picks are desired, it is necessary to have the leno ends work so that two picks are in a shed together, but this makes an uneven cloth, and while this method can be used on some fabrics, it would not be satisfactory on a cloth similar to sample. In making a fabric such as this one, it is likely that a 50-reed was used, with four ends for each stripe and six dents for each open space. If a 50-reed was too fine to allow satisfactory weaving, a 25-reed could be used with two dents for each stripe and three dents for each open space, but probably this is not necessary. Because of the nature of the cloth, the loom speed is not so high as if an ordinary dobby pattern were being made, and usually a weaver will operate only one loom.

This naturally makes the

COST OF WEAVING

excessive, nearly one-third of the cost of production, and any economies which can be made so that a larger percentage of production is obtained are well worth while. When a net profit of one cent per yard on a fabric of this nature will return a net profit of about $100 per loom per year with a comparatively low weaving production, it can be seen that care should result in a good profit, especially when such large opportunities are offered. It is a very good plan when such fabrics as these are being made to take the very best and most reliable weavers obtainable and put on looms producing this cloth, paying

PATTERN.

70/2 Sea Island combed mercerized....	2/1		4		4				4		4	2/1		=	896
120/2 Sea Island combed mercerized....		1		4		1		1		4			1	=	636
100 denier artificial silk...............							2/2							=	408
	16×		102×									16×			1,940

100/2 Sea Island combed mercerized. 44 picks.
50 reed; 42″ width in reed, 39½″ finished width.
49 × 44 over all finished count.

YARNS.

	Cotton.	Labor, waste, twisting, mercerizing, etc.		
70/2 Sea Island combed, 1½″ sta.; 14 hank dou. rov.,	28c.	44½c.	=	$ .72½
100/2 Sea Island combed, 1⅝″ sta.; 20 hank dou. rov.,	30c.	65c.	=	.95
120/2 Sea Island combed, 1¾″ sta.; 24 hank dou. rov.,	32c.	80c.	=	1.12
100 denier artificial silk, 40,000 yards per lb.,			=	2.75

COST.

824 ends 70/2 combed....................	+ 15% take-up	= .0329	@	$ .72½	=	$ .0239
72 ends 70/2 combed....................	+ 4% take-up	= .0026	@	.72½	=	.0019
636 ends 120/2 combed....................	+ 4% take-up	= .0131	@	1.12	=	.0147
408 ends 100 denier artificial silk..........	+ 2% take-up	= .0104	@	2.75	=	.0286
44 picks 100/2 combed..................................		= .0440	@	.95	=	.0418
Weaving						.0625
Expenses						.0156
						$ .1890
Finishing, etc.						.0200
						$ .2090
Selling						.0075
						$ .2165

Retail price, 79c. per yard.
Retail purchasing price about 50c. per yard.
English mill price probably less than 30c. per yard.
Import duty about 13c.
Yards per pound, 9.71.

them a good salary rather than a price per piece.

SMALL NUMBER OF SECONDS.

Under such an arrangement the best quality of cloth will be made, and production will be at the highest point, a small loss through seconds being noted. The leno weave used is the ordinary gauge one, with the crossing thread changing every pick, and as this has been taken up in detail at other times no further explanation is needed. One other feature of this cloth is the size and kind of yarn used. Few mills in the domestic market would make three kinds of two-ply yarn when making such a fabric. In the cotton staple used for the various sizes we have used a staple longer than the yarn sizes require, unless they are to be mercerized; that is, 70-1 or 70-2 ordinarily would be made of 1⅜-inch cotton, or even less. Only for special purposes would cotton longer than this be used for the above yarn size. Good yarn is very essential for the making of a fabric in which the yarn shows so clearly, and yarns of this character are usually gassed. This singes off the fibres which protrude giving a round, rod-like appearance. Through the use of

LONGER STAPLE COTTON

the twist per inch can be reduced somewhat over the ordinary amount, thus giving better results when the yarn is mercerized. Yarn improvement has been steady for the past five years in domestic mills, this being brought about through necessity We have seen single-yarn fabrics made in domestic mills somewhat similar to sample, and which compared very favorably indeed when price was considered. Then this cloth has used artificial silk for the stripes, which largely give it its character. No objection of any magnitude can be offered when this material is used in such a manner. The cotton yarn gives all the strength necessary and will hold the artificial silk even when soaked continually in water The luster is one of the large reasons why the cloth is attractive.

WEAVING MORE DIFFICULT.

Possibly one reason why mills here have not used it is because of its rubbing and breaking in weaving. Of course, it is more satisfactory when used in coarse count cloth, but future use will surely be large. Anything which causes a lot of trouble or which makes loom production small is avoided by domestic mills. The large use which is taking place in foreign mills is clearly illustrated in the importation of voile cloths.

824 ends ÷ (70/2 × 840) = .0280, weight of 70/2 leno yarn without take-up.
15% take-up in weaving.
.0280 ÷ .85 = .0329, total weight of 70/2 leno yarn.
72 ends ÷ (70/2 × 840) = .0024, weight of 70/2 selvage yarn without take-up.
4% take-up in weaving.
.0024 ÷ .96 = .0026, weight of 70/2 selvage yarn.
636 ends ÷ (120/2 × 840) = .0126, weight of 120/2 yarn without take-up.
4% take-up in weaving.
.0126 ÷ .96 = .0131, total weight of 120/2 yarn.
408 ends ÷ 40,000 yards silk = .0102, weight of artificial silk without take-up.
2% take-up in weaving.
.0102 ÷ .98 = .0104, total weight of artificial silk.

$$\frac{44 \text{ picks} \times 42'' \text{ reed width} \times 36''}{36''} = 1,848$$

yards of filling yarn per yard of cloth.
1,848 ÷ (100/2 × 840) = .0440, weight of 100/2 filling.
.0329 + .0026 + .0131 + .0140 + .0440 = .1030, total weight per yard.
1.0000 ÷ .1030 = 9.71 yards per pound.

FAST COLOR, MERCERIZED JACQUARD SHIRTING

During the past few years there has appeared on the market various new fabrics which have been made possible through some improvement of manufacturing or finishing. This cloth is one of an imported line, and the reason we have presented it is as much because of the price as because of its novel features. It would seem as if there was a large enough demand for exclusive styles to make it possible for domestic mills to produce and sell them and still have no friction be-

tween the various buyers through having the same styles.

It is possible to purchase as small an amount

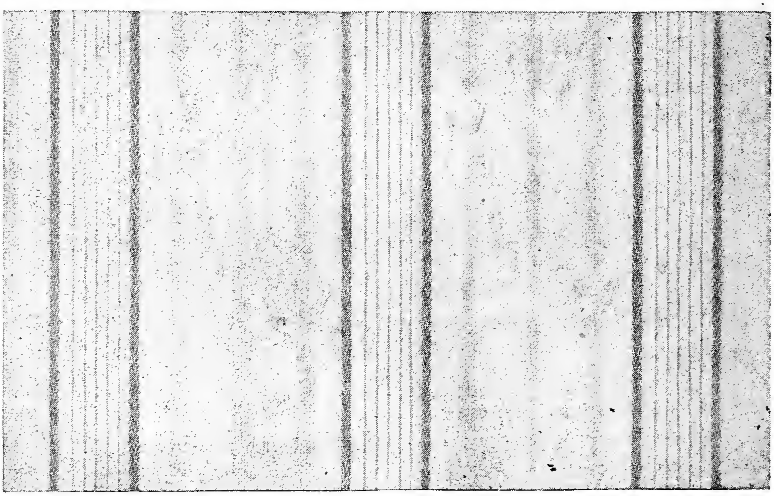
AS 250 PIECES

of such a style as the one considered and if a trip through some of the exclusive stores shows anything it is that many lines might be purchased with less chance of overlapping on styles than is now noted from domestic mills. In our cost we have given high ranges of profit, and it is very likely that this cloth could be made in the exact construction so as to be sold at retail for 35 or 39 cents instead of the 45 cents which we have given. The retail price actually is 55 cents, and shows how much the consumer pays extra just because the pattern is exclusive. Leaving out the question of price to consumer entirely, is it not worth while to make it possible for domestic mills to produce the material which is purchased abroad?

If a large portion of the cloth now purchased of foreign countries was made in domestic mills, would not the added orders make a better balance in the operation and eliminate some of the slack times which are customary every few years? The old idea which was held in past years that domestic cloth was

NOT SO GOOD AS IMPORTED

material has been proven time and again to be false when the actual facts have been obtained, and in this individual instance it can be said that any one of a dozen mills in the domestic market could and would produce a cloth as good as that analyzed, and various finishing plants are eminently able to finish such materials of domestic manufacture.



Fast Color, Mercerized Jacquard Shirting.

The facts are that there are many retail buyers who go abroad and purchase cloth which could be obtained in the domestic market, let alone mentioning the savings which might be effected in price. Of course, there are some buyers who are capable men and understand cloth and something regarding its manufacture and construction, but many of them invariably get stuck and the only thing which saves the situation is the fact that excessive profits are possible. Probably the one large reason why some of the big retailers, who do converting for themselves, started into the business was

because they could produce styles which equalled or surpassed many imported lines and at a large saving in price. Many of such styles were sold as imported lines, but nevertheless they helped domestic mills, for it acted as an incentive toward the making of newer and better cloths. Without any question probably 75 per cent of the fancy cotton cloth now imported could be made so as to be sold at a lower price to consumers in the domestic mills.

MORE CO-OPERATION.

A little more co-operation between buyers and sellers in the domestic market and more confidence in domestic styles would work wonders in this direction. Altogether too much dependence has been placed on foreign styling, as contrasted with that in domestic mills, and while each country has much to learn from the others, conditions are developing which make it rather impracticable to follow styles too closely. Large buyers are hurting manufacturers when they purchase fabrics which could have been made in domestic mills. If there were but few instances where cloth purchased in foreign markets could be made in domestic mills, little attention would be necessary, but this is not true, and much of the cloth purchased does not need to be. There is, of course, a certain amount of blame to be attached to domestic mills or converters for not going more strongly after this exclusive trade, but in grey goods mills, in which the sample and similar cloths are produced, the patterns and constructions are developed by buyers, and mills merely produce what buyers ask for. The same amount of zeal used among domestic sellers, which some buyers are accustomed to use in foreign markets, would make much more possible in the making of novelty fabrics.

Various interesting details are necessary in the production of a fabric of this character. In the first place, three beams are necessary to produce the cloth satisfactorily. One of these beams contains the ground yarn, a second the colored yarn, which takes up less in weaving, while the third carries the yarn which composes the cords. The fabric is woven in the grey state excepting the yarn which composes the colored stripes, which are of color fast to the bleaching process. In the analysis, we noted the fact that the cloth was woven on a 600-jacquard loom, and with three repeats of the pattern to every repeat of the machine tie-up. Usually, in making up patterns of this character, the mill

HAS TO VARY THE DESIGN

to suit the tie-up of its looms; that is, if a pattern was drawn by a buyer to be, say, 2 1-3 inches wide, and a mill contained looms with a 5-inch tie-up, it would be necessary to use two repeats in the machine, giving a width in the reed of about 2½ inches, or if the pattern was drawn 1½ inches wide, it would be necessary to use three repeats, giving a reed width of 1 2-3 inches, instead of 1½ inches; also, if a pattern was drawn 4 inches wide it would be necessary to readjust it, making 5 inches the reed width. Many 600-jacquard looms are tied up 120 hooks per inch, giving a reed width of 5 inches, and unquestionably this pattern is made on such a machine.

600 machine ÷ 120 hooks or threads per inch = 5 reed width.

There are exactly 600 threads used in the machine or total pattern repeat and, therefore, no hooks are cast out. A fault which is present in the pattern as woven, although one which few consumers would detect, is the fact that there are silk threads of ground yarn

BETWEEN COLOR AND CORD

on one side of the stripe, while there are 8 ground threads on the opposite side of the stripe. This gives a slightly unbalanced pattern, but it was evidently a mistake of the designer rather than the weaver, for it appears regularly throughout the cloth width. This fabric is a much higher count cloth than is ordinarily seen in shirting lines, and the yarns are finer than many use, but similar fabrics with

even finer yarns are made in quantities in domestic mills.

One feature of the cloth is that it has filling of soft twist yarn, so as to give a better result when finished. The use of soft twist yarn aids, because the cotton fibres lie more nearly parallel, and when the fabric is mercerized, these fibres reflect the light better, giving a higher luster. In making soft twist filling it is customary to use a longer staple than if ordinary yarn is usually about 3 for ring frames, but cases have been known where the standard was as low as 2¼ on rather coarse yarn and with especially long cotton, although this is seldom seen The standards for mule twist are somewhat less than for ring frames, but probably 2¾ to 3 represents the majority. The amount of twist will depend a whole lot on the cotton being used and the kind of cloth being made.

PATTERN.

60/1 Am. combed grey.........	48	64		6		8		72	64		6		8		64	48	=	3,742
60/1 Am. combed colored......			8				8			8				8			=	336
40/2 Am. combed grey.........					2							2					=	210
				5 ×							5 ×							4,288

60/1 Am. combed filling, soft twist. 116 picks.
60 reed, 35⅓" width in reed, 32½" grey width, 32" finished width.
128 × 116 grey count, 134 × 113 finished count.

YARNS.

		Cotton.	Labor, waste, etc.	Twisting.	Dyeing.	
60/1 Am. comb. warp,	1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.			= 40½c.
60/1 Am. comb. col.,	1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.		16c.	= 56½c.
40/2 Am. comb. warp,	1⅛" sta.; 8 hank dou. rov.,	20c.	10½c.	2c.		= 32½c.
60/1 Am. comb. filling,	1⅜" sta.; 14 hank dou. rov.,	24c.	15¾c.			= 39¾c.

COST.

3.742 ends 60/1 Am. combed...............+ 10% take-up = .0824 @ 40½c.	=	$ .0334
336 ends 60/1 Am. combed...............+ 8% take-up = .0073 @ 56½c.	=	.0041
210 ends 40/2 Am. combed...............+ 2% take-up = .0128 @ 32½c.	=	.0041
116 picks 60/1 Am. combed.............................= .0813 @ 39¾c.	=	.0323
Weaving		.0392
Expenses		.0376
		$ .1507
Selling		.0030
Mill cost		$ .1537
Mill selling price (about)		$ .1750
Finishing, mercerizing, etc.		.0150
		$ .1900
Converter's selling price		$ .2500
Jobber's selling price		.3000
Retailer's selling price		.4500

Yards per pound, 5.44 grey.
Made on a 600-jacquard loom, 3 repeats per section.

were being made, for inasmuch as there is a smaller amount of twist a longer length of fibre is necessary to give sufficient strength to weave or to mercerize. Take the cloth we are considering and

IT WILL BE NOTED

that 1⅜-inch staple was used for warp and filling. If this filling were not made soft twist it is very likely that cotton not over 1¼ inches would have been used. The standard of twist used

Very often designs are planned so that the cloth must be made to one side of the jacquard tie-up, or, in other words,

THERE IS A WIDER SPACE

between the shuttle box and cloth on one side than there is on the other. Where there are a number of pattern repeats in each 600 hooks little trouble will result, because a wide variation cannot occur, but with only one stripe to a pattern, or rather to the 600

hooks, sometimes bad weaving will result and often the design has to be repainted To give the best place in the tie-up to weave this fabric the problem would be as follows: There are 4,192 ends in the warp, excluding the selvages, which are worked separately, and as most jacquards of this kind are tied up 40 inches wide, we will assume that such was the case with this cloth.

120 ends per inch × 40″ = 4,800, total harness in tie-up.
4,800 — 4,192 = 608, total harness not used.
608 ÷ 2 = 304, each side not used.

As 600 machines have 12 hooks in a row, we have

304 ÷ 12 = 25 rows + 4 hooks.

In other words, to make the cloth in the center of the tie-up we would not start to draw in warp yarn until the 5th hook on row 26 in the machine in section No. 1 of the jacquard tie-up, and when we had drawn in all the ends we would find that the last thread would be drawn on the 8th hook in row 25 in section No. 8. As one section takes 5 inches, the total width, or 40 inches, would give 8 sections.

Of course, this layout is rather simple, but when patterns are

MORE COMPLICATED

and there is a large and varying cast out the problem is not so easy, but if made out correctly at first no subsequent changes are necessary. It should be as common a practice to balance jacquard patterns as it is dobbies, but, unfortunately, it is not, and much improvement might be made even in many of the dobby patterns which are sold.

Mills making fabrics of this character seldom dye their yarn, for one reason that they could not do it as successfully as those now doing it, for another reason each contains rather small quantities, making a small amount necessary, and as the mills make a large proportion of grey cloth, the expense would be high, probably higher than the present cost, and with no outlay for a dyehouse to increase the capital necessary. There is no question, however, but that many new lines will be produced.

One year ago was

PROBABLY THE EARLIEST

any of these lines were sold by retailers in quantities, and most of the fabrics offered were lots left from various shirt makers, and patterns were not entirely suitable, but there is a future in this direction. The weights of the yarns and cloth are obtained as follows:

3,742 ends ÷ (60/1 × 840) = .0742, weight of 60/1 grey without take-up.
10% take-up in weaving.
.0742 ÷ 9 = .0824, total weight per yard of 60/1 grey warp.
336 ends ÷ (60/1 × 840) = .0067, weight of 60/1 colored without take-up.
8% take-up in weaving.
.0067 ÷ .92 = .0073, total weight per yard of 60/1 colored warp.
210 ends ÷ (40/2 × 840) = .0125, weight of 40/2 grey without take-up.
2% take-up in weaving.
.0125 ÷ .92 = .0128, total weight per yard of 40/2 grey warp.

$$\frac{116 \text{ picks} \times 35\tfrac{1}{3}'' \text{ reed width} \times 36''}{36''} = 4{,}099$$

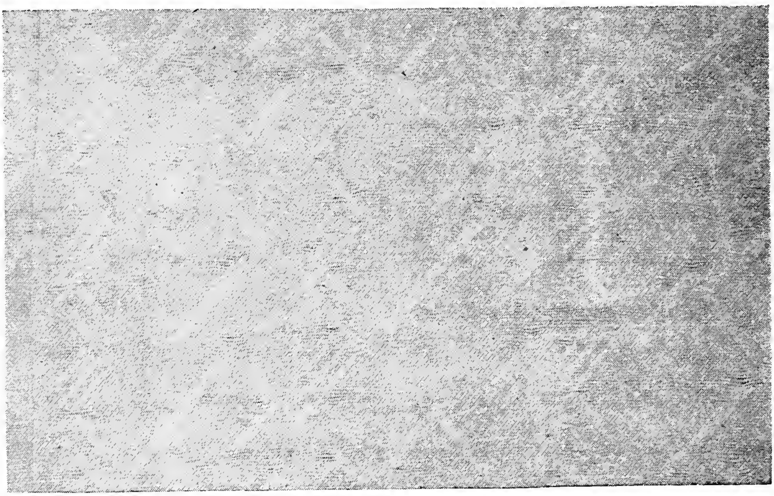
yards of filling per yard of cloth.
4,099 ÷ (60/1 × 840) = .0813, total weight per yard of 60/1 filling.
.0824 + .0073 + .0128 + .0813 = .1838, total weight per yard.
1.0000 ÷ .1838 = 5.44 yards per lb. grey.

FLANNELETTE NOVELTY

One of the most interesting and also one of the largest used fabrics is that class ordinarily known as flannelette. In general this class could be said to contain any kind of cloth made of cotton which is napped on both sides, and used for ordinary purposes, such as kimonos, nightgowns, coverings, and very many other purposes. The present season has seen a large demand for all kinds of cloth of this character, and prices might be called high, and profits should be exceedingly satisfactory to mills producing them. Cloth of this character is made in white and solid colors, in woven stripes, in checks and in a great variety of printed patterns. Usually such fabrics would be considered rather heavy in weight, for the yarns used are seldom finer than 30s in the warp and 16s in the filling. The reason the fill-

ing is heavier than the warp is because of the napping operation.

In napping such fabrics as the ones considered, the machinery which accomplishes the purpose does it as the cloth is moving quite rapidly through the machine, and naturally it would affect the filling yarn. To give sufficient strength to make the cloth a satisfactory article it is, therefore, necessary to make the filling heavy enough to stand the napping operation and give satisfactory service afterward. One reason, in addition, why this is necessary is that warp yarn has to have a larger amount of twist in proportion than does filling yarn, because it has to stand the strain of weaving, and filling can be soft twisted with much less difficulty in weaving. It is also customary in making this kind of cloth to use plain weave. This is done for these two reasons: The first because the napping operations largely cover up any weave in the cloth, and second, because plain weave binds in the threads better and makes stronger cloth.



Flannelette Novelty.

YARNS USED.

There has been quite a good deal of improvement in the making of such fabrics in recent years. They used to be made of yarn dyed after it was spun, and this process is employed to-day to an extent, but many mills now make their fabrics of yarn made from dyed cotton. This has been done without question in the fabric being considered. The white cotton in such fabrics is bleached before being spun, and while this is objectionable, inasmuch as the whites are not so clear as if the cloth was bleached after being woven, the results are satisfactory in practically all instances

In the cloth being considered there are a number of features not common in cloth of this character. In the first place it is woven on a box loom, and while quite a few patterns are made in this manner, the large majority of them are not made on this kind of a loom. In the second place the fabric contains novelty yarn, in addition to being woven on the box loom, and because this yarn is seldom seen in cloth of this character it may be well to explain the method of making.

NOVELTY YARN.

To produce such a yarn comparatively few changes are necessary in

ordinary machines, although there are special machines sold for accomplishing such results. The yarn is composed of two ends of 20s yarn for ground, and so far as this part of the result is concerned, it is no different than the making of ordinary 20-2 ply, but in addition there is introduced into the yarn, about every four and one-half inches, a bunch of another color of cotton. To produce this, there must be an extra set of rolls, either on the twister, if it be made on a novelty twister, or on the frame which produces the yarn. This extra set of rolls has an intermittent motion forwarding the amount of dyed roving necessary and spacing it at the desired lengths. This roving is introduced between the two ends of 20-1 yarn, when the twisting operation is taking place, and 20-1 yarn twists around the roving, making the bunch firm and capable of being woven. Such yarn does not always weave well, and in this identical cloth the yarn in the warp is drawn in a single end in a dent, instead of two ends, as is the case in the rest of the cloth. This process allows a larger amount of space, and is not liable to create a great amount of rubbing to spoil the nub.

AUTOMATIC LOOMS.

A few years ago practically all of such fabrics were woven on ordinary plain looms, with no stop motions attached and nonautomatic in any way. To-day, many of such fabrics are made on automatic looms, that is, the ones which are made of solid color and with striped patterns, although only few checked paterns are made in this manner. A good many looms, if they do not have the automatic changing arrangement, have some kind of a stop motion for the warp yarn which makes it possible for a weaver to produce more first quality material. Practically all of such cloths are made in the older style of mills, and are finished when they are delivered by the mill. The cloth constructions all vary, and probably no two mills produce identical fabrics, although cloth weights may be somewhat similar.

The yarns used and the cloth construction are ones which each mill has developed, and which is probably more economical for them than any other. The large amount of orders allows mills to make these constructions continuously, with very few changes taking place, the yarns being the same size from year to year, and the cloth remaining practically the same. It is also even true that cloth prices vary ' comparatively small amounts. This is done so that the various sellers may retail the cloth at a certain price. This method makes it necessary to have a comparatively high price some years, in comparison to the cost of producing, while at other times the selling price shows a rather small profit.

PROFITS AND COSTS.

In most instances the cost of producing a fabric of this character would be somewhere about 25 to 26 cents a pound. If a plain cloth be considered the cost would be less, while if a novelty cloth be wanted it would be more. The cloth considered has a higher price than most of such materials, because it has such a novelty construction. One fact in this connection is that all styles are sold at practically the same price, and while the average sale may show a good profit, there will be certain cloths in the lot which are sold that will show a very high profit, while others will show a smaller one, the amount depending on the cloth construction. A comparatively easy method of obtaining the cost per yard is to find the weight of the fabrics as woven, and dividing by the amount previously stated as the cost per pound. This is not only approximate, but is sometimes of value.

Another thing which few buyers consider regarding various cloths is the fair mill profits. Such a cloth as we are considering has a rather small number of picks per inch. If another cloth be considered with twice the number of picks per inch, the profit per yard should be twice as high as for the cloth considered, or approximately so, and a cent a yard profit on the cloth being considered would mean a profit each week per loom of from \$2.25 to \$2.50, or a profit per year of

about $125 a loom. This is evidently a very good return on the capital necessary in building a mill to produce cloth of this character.

CLOTH WEIGHT.

One other feature in these cloths is the different appearance of the fabric when woven and when sold, which is due to the napping operation. It is, however, true that the fuzz, which appears on the face of the cloth, wears off rather easily, and in this way, the material does not give the best of satisfaction, although it answers the purpose fairly well. It will be evident from an examination of the cloth that there must be a loss in weight when the cloth is napped. The amount lost will depend a good deal on the fabric and on the amount of the napping operation, but it is likely that in a cloth of this character the filling yarn will lose as much as 15 per cent, or even more, in weight. By pulling out a few threads it will be seen that the warp has been affected very little, the yarn appearing practically the same as it would have if no napping had been employed. Ordinarily, fabrics of this nature are heavier than five yards per pound, and on the finer weights the napping operation might make the cloth from one-half to three-quarters of a yard lighter than it was when woven.

PRINTED FABRICS.

In general it can be said that patterns made by printing are not nearly as satisfactory as if they were woven, for the colors do not penetrate through the cloth, and when the nap wears off, which it partially does, at least, its color appears lighter than it otherwise would. The patterns are engraved upon copper printing rolls the same as they are for the patterns used on dimities, lawns and other printed cloths, but it is customary, after the fabric has been printed, to give it a very light run on the napping machine to raise the fibre, which has been laid down in the printing operation, and to give the cloth a smoother appearance. Of course, when fabrics are made in printed patterns it is seldom that anything but white flannelette is used, although the ground of the cloth may be given a solid color by the printing operation.

COTTON USED.

In making cloth of this character, it is customary to use cotton of rather short staple, in most cases being one inch or about that amount in length. This is done because coarse yarns are used, and the napping operation breaks the fibres a good deal, and it would be an uneconomical method to use high-priced cotton for such a purpose. It is also possible to use waste of various kinds in making yarn of this character, and it is usually done. One great necessity in making even yarn for the production of such cloths is to have the cotton mixed as well as possible before using in the pickers. This is usually done by running quite a large amount of cotton through the bale breaker and allowing it to stand, and when placed in the picker, instead of taking the cotton from the top of the pile and working down, it is taken from the edge and in this manner a more average quality is obtained, which necessarily results in more even yarn.

Southern mills have not gone into making fabrics of this nature as largely as they have into ginghams, possibly because the market is more concentrated on such fabrics, and because Northern mills have specialized in this direction and have kept fairly well up-to-date. It is also true that the large number of printed cloths used has kept Northern mills working on these fabrics because there are no plants in the South which make printed patterns of any kind, and the base of supply is so far from the finishing plant that the cost of shipping introduces an obstacle to their expense of making, although there are a good many woven fabrics of this nature now being produced in that locality. Most of the cloth sold is of rather narrow width, in few cases being more than 30 inches, and in the large majority of instances it is about 27 inches wide finished. Because of the napping operation the shrinkage of the cloth width is more

than it would be on similar cloths, but not napped.

YARN AND CLOTH WEIGHTS.

In analyzing a fabric of this character, ro general rules can be given. It is likely that in the majority of cases the warp yarn would be about 10 per cent finer than when spun either from the stretching, washing or the other operations employed, that is, if a yarn was spun 20s it might be about 22s in the cloth when sold. For the filling the amount of loss will vary, but in this individual case the loss was about 20 per cent. Naturally the cloth weight when sold would be lighter than when woven, but inasmuch as mills have to use the material to produce the cloth, and because little return is obtained for the loss made in napping, it can be said that the best method to consider such cloth is as it comes from the loom.

To illustrate the cloth in question we present the weights of the various yarns and the method of obtaining them. In very many instances the yarns are not separated as we have done, and they are all used together at an average price:

1,346 ends ÷ (20/1 × 840) = .0801, weight of white yarn without take-up.
.0801 ÷ .96 = .0852, total weight of white warp.
114 ends ÷ (20/1 × 840) = .0067, weight of pink yarn without take-up.
.0067 ÷ .96 = .0072, total weight of pink warp.
34 ends ÷ (6 novelty × 840) = .0067, weight of novelty yarn without take-up.
.0067 ÷ .96 = .0072, total weight of novelty warp.

$$\frac{41.8 \text{ picks} \times 30\tfrac{1}{4}'' \text{ reed width} \times 36''}{36''} = 1{,}264.45$$
yards of white filling per yard.

$$\frac{3.9 \text{ picks} \times 30\tfrac{1}{4}'' \text{ reed width} \times 36''}{36''} = 117.95$$
yards of pink filling per yard.

$$\frac{2.3 \text{ picks} \times 30\tfrac{1}{4}'' \text{ reed width} \times 36''}{36''} = 69.57$$
yards of novelty filling per yard.

1,264.45 ÷ (9½/1 × 840) = .1585, total weight white filling per yard.
117.95 ÷ (9½/1 × 840) = .0148, total weight pink filling per yard.
69.57 ÷ (6 novelty × 840) = .0138, total weight novelty filling per yard.
.0852 + .0072 + .0072 + .1585 + .0148 + .0138 = .2867, total weight per yard.
1.0000 ÷ .2867 = 3.49 yards per pound, as woven.

WARP PATTERN.

20/1 Am. carded white......	2/8	30		12		12		44		6		14	30		12		12		28	2/8	= 1,346
20/1 Am. carded colored.....			2				2							2				2			= 114
6 novelty twist............					1				1		1					1					= 34
		11× (30 to 14)																			1,494

FILLING PATTERN.

9½ Am. carded white............	42		12		12		42				= 108
9½ Am. carded colored..........		2				2			6		= 10
6 novelty twist..................				2				2		2	= 6
											124

25 reed; 30¼" width in reed, 26½" finished width.
56 × 46 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
20/1 Am. carded white, 1" sta.; 4 hank dou. rov.,	12½c.	7¼c.	=	19¾c.
20/1 Am. carded colored, 1" sta.; 4 hank dou. rov.,	12½c.	8½c.	=	21c.
9½/1 Am. carded white, 1" sta.; 2½ hank dou. rov.,	12½c.	6c.	=	18½c.
9½/1 Am. carded colored, 1" sta.; 2½ hank dou. rov.,	12½c.	7¼c.	=	19¾c.
6 novelty twist, made of 20/1 and dyed roving,	12½c.	11½c.	=	24c.

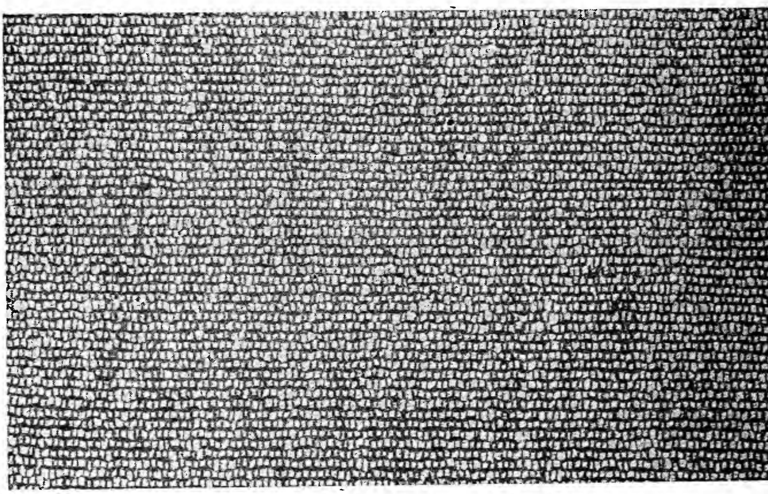
COST.

1,346 ends 20/1 Am. carded................+ 6% take-up	= .0852	@ 19¾c.	=	$ .0168
114 ends 20/1 Am. carded................+ 6% take-up	= .0072	@ 21c.	=	.0015
34 ends novelty twist...................+ 6% take-up	= .0072	@ 24c.	=	.0017
41.8 picks 9½/1 Am. carded..............................	= .1585	@ 18½c.	=	.0293
3.9 picks 9½/1 Am. carded..............................	= .0148	@ 19¾c.	=	.0029
2.3 picks novelty twist..................................	= .0138	@ 24c.	=	.0033
Weaving				.0065
Expenses				.0087
				$ .0707
Napping, finishing, etc..				.0040
				$ .0747
Selling				.0035
				$ .0782

Loom yards per pound, 3.49. Cost per pound, 27.29c.
Finished yards about 4.25 per pound.
Retail price 15c. per yard.

PLAIN WARP COTTON EPONGE

During the past year or so, there has been quite a number of new fabrics produced for sale. Of these materials, ratiné has probably been the one which has created the largest amount of interest. One year ago many styles were produced, and there was a moderate amount of buying, but then there appeared to be a partial slump in the demand, with sellers expecting that no large future operations would take place. During this same time, however, fabrics of this nature have been produced in quite large quantities in wool and combinations of wool and cotton, and also in silk, and it is freely admitted that the sale now is larger than it ever has been in the past. There is this to be said of any cloth which has as great a novelty character as ratiné regarding the sale. Interest in such fabrics does not develop all at once, but it is the continual presentation of styles and interest among the trade which makes a large sale possible. Buyers will not purchase such cloths in quantities until consumers have been educated up to the cloth, and this is a rather slow process. The making of styles in various materials also helps a great deal, and it is very likely that the sale in cotton would have continued smaller except for the increased interest in wool and silk. The idea expressed in the cloth construction is not new, for styles have been produced at various times in recent years which are practically identical with the styles now offered, but at that time there was no demand for such cloth, and the sales were of comparatively small proportions.



Plain Warp Cotton Eponge.

FACTS REGARDING CLOTH.

In the past we have analyzed a number of the more expensive cotton fabrics of ratiné construction, but in the fabric now presented we give an analysis of one of the cheaper grades which is a development from such cloths. This cloth is without doubt the largest selling cotton ratiné in the cotton goods market, and in connection with this fact, there are a number of interesting items which

we will take up in the analysis of it. It is produced by the Manville Company and is sold by George B. Duren & Sons, New York City. The cost at retail is 25 cents a yard and it is sold by jobbers at a price to allow the regular retail profits and at a price to the jobbers to allow them their profits also. The profits of the makers of this cloth will be taken up in detail later. Fabrics of this character are used for very many purposes. such as dresses, waists, trimmings, hats, coverings, men's vests, and very many other purposes, which do not have such great importance.

YARNS.

Quite a good deal of ingenuity has been used in the making of this fabric, the ratiné effect not being produced by both warp and filling, as in many of the previous samples sold, but by the filling alone. The warp is made of plain dyed yarn, no different in character from that used for many of the ordinary dyed fabrics which have a wide sale. In this individual fabric the effect produced is made by the difference in color between warp and filling and by the novelty character of the filling yarn. This novelty filling is not made like many of the yarns composing ratiné cloth, but it is what might be called a nub yarn. Many of the earlier fabrics of ratiné constructions were made of loop yarns. The cloth count is very low, although, because of the heavy character of the filling and because of the yarn roughness, the cloth has a comparatively firm texture. The count is 66 in the warp and 24 in the filling in the finished cloth. In regard to the novelty yarn, it can be said that two twisting operations are necessary, the second one being for the purpose of binding the previously produced yarn so that it can be woven. Fabrics of this character have been made in quite large quantities in the past, but the larger share of them have been composed wholly of grey yarn, and naturally, they do not show the novelty character which this cloth does. The warp take-up is somewhat greater than would be noted in an ordinary fabric, this being brought about through the heavy size of the filling, which lies practically straight in the cloth. This heavy filling also makes it unnecessary when weaving to have the cloth so wide in the reed as if a gingham were being made.

METHOD OF FINDING YARN SIZES.

Of course, the problem of finding the warp size is a rather simple one, because the yarn is only ordinary yarn, and if a few ends be taken from the cloth and sized in the ordinary manner, the yarn size and weights can be obtained. This process can also be adopted regarding the filling yarn, and it will give the ultimate size when the yarn is made up. It does not, however, give the sizes of the yarns which compose the thread when woven. There are a number of methods by which such yarn size can be figured, so as to check up the yarns used, and the ultimate size. Possibly, the clearest method is to find the take-ups on the three yarns which compose the finished novelty. The take-ups are found in the following manner: If the threads which compose the yarns be pulled apart, their lengths being measured carefully, the take-ups will be as follows: Figuring that the novelty yarn is 3 15-16 inches, as taken from the cloth, the last binder thread which is twisted to hold the nubs in place would be four inches in length, the ground thread on which the nub is made is $4\frac{5}{8}$ inches in length, and the yarn which composes the nub would be $8\frac{3}{4}$ inches in length. The take-ups would be 2 per cent for the binder, 15 per cent for the ground yarn and 55 per cent for the nub yarn.

$3.9375 \div 4.00 =$ about .98 or 2% take-up.
$3.9375 \div 4.625 =$ about .85 or 15% take-up
$3.9375 \div 8.75 =$ about .45 or 55% take-up

When this has been accomplished, the yarn can be sized in the ordinary manner and the yarn sizes obtained. To secure the size of the three-ply thread the process is similar to that used with an ordinary three-ply thread made of different numbers of yarn, the various sizes being the ones

obtained plus the take-ups obtained previously:

25 yarn size × .98 = 24.50	binder yarn size or ratio.
25 yarn size × .85 = 21.25	ground yarn size or ratio.
25 yarn size × .45 = 11.25	nub yarn size or ratio.

25 ÷ 24.50 = 1.020
25 ÷ 21.25 = 1.176
25 ÷ 11.25 = 2.222

4.418

25 ÷ 4.418 = 5.66 figured size, also actual size.

It will be noted that the resulting yarn size is 5.66, which is the size actually obtained when the yarn is weighed before being dissected. It can be said that the cost of making such yarns is higher than for ordinary work, but is not so large an amount as many believe who have not had experience in manufacturing.

In many instances, yarns of this character can be made on ordinary spinning frames which are adjusted for the purpose. At other times they are made on twisting frames which are rearranged, and it is also possible to purchase machines for making such yarns. The ultimate cost is determined largely by the amount of experimentation necessary before the correct results are obtained. It is easy to make novelty yarns of this character, but it is not always so easy to obtain the combination which produces good results when woven. If orders be of quite good size, the cost of producing is relatively small. The second twisting operation is of minor importance and the cost of doing it is rather small, mainly for the reason that comparatively small twist is necessary when placing the binder on the cloth, and the production is large.

NOVELTY YARN MAKING.

It is very likely that the larger share of such yarns are made on spinning frames which are rearranged for such purpose. In making yarns of this character, the two threads in the first twisting operation are usually delivered at about the same speed, but the ground thread moves forward only at intervals. In this individual case, the nubs are spaced at intervals of about five-eighths of an inch each. Sometimes such yarns are made by a slide which moves up and down, spacing the extra yarn delivered at the points where desired. One of the points to receive careful consideration in any such kind of yarn production is that relating to strength. When the yarns being used are of fine sizes, as many are, it is usually necessary to use two ends for ground instead of one, but in this instance, the yarn is of such coarse character that comparatively little attention need be given to this item, and another reason why less care is necessary is because the yarn is used for filling instead of warp. If the novelty yarn was used for warp, greater strength is necessary, and, in general, the nubs and loops have to be bound in more firmly because of the rubbing action exerted by the reed. The combinations in such yarns are practically numberless, for they are made in combinations of various materials, in combinations of various colors, with nubs spaced at regular and also at irregular distances, and then there is the wide variety caused by the combination of different sizes of yarn. It is probable that no two mills use exactly the same sizes of yarn, the same amount of twist or produce the same effect, although, in general, the results may be somewhat similar.

WEAVING.

There are certain features regarding the yarn which we have brought to notice as being different from those in ordinary cloth, but there are also items which are of interest relating to the production of the cloth. In the first place, the filling which sizes about 5½ is so heavy that it lasts only a short time when the loom is in operation. This makes the chief occupation of the weaver that of changing the filling when it runs out, and at the mill, such cloths are usually called filling jobs. This continual changing of the filling bobbins also makes the percentage of production rather low in comparison with many fancy fabrics. It is also true that a weaver cannot operate so many looms as on ordinary goods largely because of this above-mentioned continual changing of shuttles. Because the

weaver does not operate a great number of looms does not mean that the yardage production per loom or per weaver is not large, for it is. This is occasioned because of the small number of picks per inch, namely, 24. This will be clear to anyone who has ever been connected with cloth making. The small number of picks also explains other important features regarding the cloth. It is sometimes necessary to operate looms at a somewhat lower speed than for other plain fabrics, although not much slower than would be noted on ordinary dobby cloth.

PROFITS.

As previously stated, this fabric is without doubt the largest seller of any similar domestic cloth, and also has as low a retail price as any yet brought to light. This low price does not indicate that the makers are not reaping a harvest from such cloth manufacturing. It will be noted from the analysis given that the cost of manufacturing and selling is practically 9 cents per yard. This includes all the expenses which should be incurred up to the jobber. The selling house, it is understood, acts only as a distributing agency for the mill, and the costs for selling this cloth are given at a conservative level and one which many houses could equal. Under such circumstances, practically all the profits made would accrue to the mill. The net profit, as figured, amounts to about 4 cents a yard. This does not seem great for a novelty fabric, but it is large when the actual profits are considered. Due to the very material production per loom, a profit on a fabric of this character would be much larger than on one where the number of picks was higher. therefore 4 cents per yard on this 24-pick cloth means a profit per loom per week of at least $17.50. This gives a rate of profit per loom per year of approximately $900. At a loom valuation of $800. and this is conservative for a mill producing a fabric of this kind, a net profit should be obtained of over 110 per cent a year. It is very likely that, with the economies which this corporation is known to adopt, possibly more than this amount is being secured, and the figures are approximately correct for other mills which might be inclined to produce this cloth.

JUSTIFICATION FOR PRICE.

It can be said that very few cases indeed are ever noted in the domestic markets where profits are so excessive as they are on this fabric, but there is something to be said regarding these facts concerning the cloth and the profits being obtained. On plain materials which are now being made, and which have been manufactured continuously in large quantities, such as sheetings, duck, denims, flannelette and other similar cloth, a small profit a yard is all that any mill expects to make, because they are regular fabrics and require comparatively little ability to produce. Operations are very regular on such fabrics, and changes in style seldom take place. Under such conditions, when it is considered that present cloth prices actually do represent a net profit of 25 per cent on many kinds of these cloths, even though some are inclined to dispute the fact, the comparison of profits shown on this cloth does not appear so excessive.

It takes ability and foresight to work out a fabric which is adaptable to a certain style and which can be made at a price cheap enough to have a large sale. Even in comparison with many of the imported fabrics which have sold at $1 a yard, it can be said that this cloth shows as good value as many of them, and at 25 cents a yard retail. In so far as the value to the consumer is much greater than it was a while ago, it can be said that the mill profit on such a cloth is justifiable. There is a greater chance taken in making such cloth, and it is seldom that one is developed which shows the high rate of profit named. Competition is also very keen in the making of such lines, and only by getting in ahead of others can high profits be obtained, and in a short time others are likely to force competition to a point where profits are not so large. Cloths of this character have only a short run at best, and then combinations and adaptations are necessary with the materials which

happen to be in style, so that high profits of this nature are comparatively short lived.

IMPROVEMENT IN FABRICS.

In connection with the analysis of a novelty fabric of this character it may be of advantage to again bring to notice the fact that the domestic industry has improved a great deal in the past five years. This cloth is a good illustration of the development of a fabric to suit a demand, and that it is an improvement in price, so far as the consumer is concerned, is worthy of notice, even though large profits are being secured. An examination of the various lines of cloth which are being shown by converters and converting jobbers will emphasize the fact that probably greater improvement has been made in the past five years in cloth manufacturing in domestic mills than has ever taken place before in the same length of time. Mercerized shirtings and dress goods, fast colors in combinations, decorations of real and artificial silk, the development of fabrics for a certain demand, and various other items of interest are very evident. The new combinations have made another field which has almost established a new industry in certain directions. This is shown in one way by the large use of mercerized cloths for men's shirtings. Without doubt, the present style in men's shirts would never have been used to a great extent except for the mercerization process. Many other items might be given along the same line, and so far as the styling is concerned, imported fabrics show no greater, if as great, adaptability or effectiveness.

PATTERN.

28/1 Am. carded warp, colored. 1,824 total ends.
5.66 novelty, 3-ply filling. 24 picks finished.
32 reed, 28" width in reed, 27" wide finished.
67 × 24 cloth count.

YARNS.

	Cotton.	Labor, waste, etc.		
28/1 Am. carded, 1 1/16" sta.; 5½ hank dou. rov.,	12½c.	16¼c.	=	28¾c.
5.66 novelty, 1 1/16" sta.; 5 hank dou. rov.,	12½c.	20½c.	=	33c.

COST.

1,824 ends 28/1 Am. carded + 10% take-up = .0857 @ 28¾c.	=	$ .0246
24 picks 5.66 novelty = .1414 @ 33c.	=	.0467
Weaving		.0056
Expenses		.0048
		$ .0817
Washing, etc.		.0040
Mill cost		$ .0857
Selling		.0034
		$ .0891

Selling house price about 13c. net per yard.
Jobbing price about 16½c. per yard.
Retail price 25c. per yard.
Yards per pound, 4.40.
Cost of producing at mill = 37.71c. per lb.

FINDING YARN WEIGHTS.

In connection with what we have previously presented regarding the finding of yarn sizes, the finding of the yarn weights and from this the cost of the cloth is a rather simple proceeding. The cotton used in this fabric is no different than that used in many of the ordinary fabrics, the whole result being obtained from the combination of yarn and the method of making. The weights are obtained as follows:

1,824 ends ÷ (28/1 × 840) = .0771, weight of warp without take-up.
10% take-up in weaving.
.0771 ÷ .9 = .0857, total weight of warp per yard of cloth.

$$\frac{24 \text{ picks} \times 28'' \text{ reed width} \times 36''}{36''} = 672 \text{ yards}$$

of filling per yard.
672 ÷ (5.66 novelty × 840) = .1414, total weight of filling per yard of cloth.
.0857 + .1414 = .2271, total weight per yard.
1.0000 ÷ .2271 = 4.40 yards per pound.

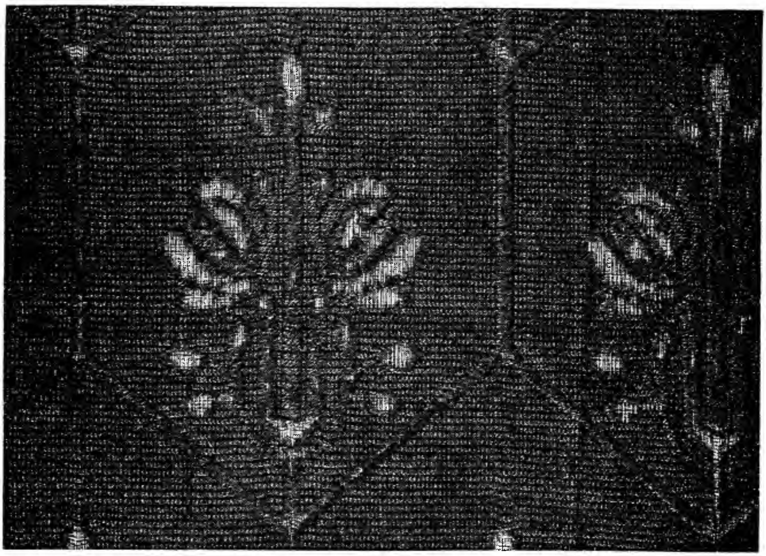
COTTON DRAPERY

This fabric is one of the very many which have a rather wide distribution, the prices varying greatly, depending on the quality and weight of the goods, the material from which

they are made and various other details of manufacturing. In a general way, such fabrics are not only made in rather small quantities at the mills, but they are sold in very restricted amounts by the retailers. The various avenues of distribution are rather small, and do not compare with those noted on the ordinary kinds of cotton fabrics, such as dimities, lawns, flannelettes, etc. All the above items affect the price of the goods, and, naturally, most of them are rather expensive. The fabric which we are to consider is one of the very cheap cloths which are made and sold for the use as noted. Such cloths are sometimes used for other purposes than draperies, but this purpose forms the largest portion of the sales. It can be said that the profits from making and selling these cloths are larger than for other cloths, mainly because the distribution is small, and the amount of yardage sold is a rather small amount. These cloths are very similar to many which are used for hammocks, and other purposes where the cloth count is low, although it can be said that the yarns in this cloth are much finer than those ordinarily noted in hammocks.

WOVEN ON JACQUARD LOOMS.

Many of the cloths such as that analyzed, and, in fact, most of the ones sold in any large quantities, are produced on jacquard looms. These looms are tied up in a coarser count than that noted in most cotton and silk fabrics, few of them being as high a count as 100 per inch, and most of them much lower than this amount. The cloth we have analyzed was probably made on an ordinary 400 jacquard head, with a tie-up of somewhere in the vicinity of 50 threads per inch. This makes the total pattern repeat about 8 inches in width. It may be possible that this cloth instead of being made as noted was tied up 100 per inch with a pattern of about 4 inches instead of 8 inches. The repeat of the pattern is about 4 inches wide, there being two repeats to the jacquard machine. Of course, if the machine was tied up 100 per inch there would have to be about



Cotton Drapery.

one-half of the machine cast out in the weaving of this cloth. In a great many fancy drapery fabrics the jacquard machines are tied up so as to produce a border. This is done by having a certain number of hooks in the jacquard machine set aside and tied up so that they operate only on one side of the cloth. In other cases, fabrics are woven double width with an open space down the center of the cloth, and when the fabric is woven, this open space is cut and made into a sort of fringe. At other times the fringe, if there is any, is added after the fabric is woven.

YARNS USED.

In the cloth considered the yarns which have been used in manufacturing are not different from those noted in very many fabrics, but the combination is not customary. The warp yarn is composed entirely of black, and the yarn is such as might be noted in many medium or rather fine dyed yarn fabrics, although the cloth count is rather low, being only 50 threads per inch. In a great many of these fabrics the cloth count is low, not only in order to aid in producing a fabric at a low cost, but also to give a certain amount of softness not customary when fabrics are woven with a high count and heavy yarns. In some kinds of cloths carded yarns are used, and in other cases, the yarns are of combed construction. The figure which is woven on the cloth is made entirely by the filling, and although there are two kinds of filling used only one of them brings out the effect. In the first place, there is a fine black filling used, somewhat similar to the warp yarn. This is much finer in size than is ordinarily noted in dyed yarn fabrics. Both black warp and filling are probably yarn dyed, because, in the large majority of instances, this is the method adopted in dyeing yarns for such kinds of cloth. The filling which produces the pattern is also dyed, but instead of being black it has a golden color, and besides being dyed, it is also mercerized. As is usual, this mercerized yarn is much heavier in size than the yarns used in the ground cloth, for this mercerized yarn produces the effect, and, therefore, needs to be more prominent.

MERCERIZATION.

A few ideas regarding the process of mercerization may be of interest when this cloth is being considered, and, therefore, a few facts are given, although there has been no intention of giving a minute description. When ordinary cotton is examined, it presents an appearance somewhat like a rather flat twisted tube with curled edges. This is when ripe cotton fibres are considered. When this same cotton is mercerized, it seems to swell out and appear more like a small glass rod with many of the rough edges eliminated, and this smoothness imparts the luster which mercerized yarn contains. It must be remembered that when cotton is allowed to shrink practically no luster results, but when either cotton fibres, yarns or cloths are held out tightly when immersed, the result is a smooth and glossy appearance, which is permanent. There are various chemicals which will produce these effects on cotton fibres, but, due to reasons of economy, practically only one solution is used to any great extent. The strength of this solution will vary, depending on the temperature at which the process is accomplished, and no great difference in result is apparent even if a stronger solution than is necessary be used. As a usual thing, the shrinkage, when it is allowed, will amount to about 20 per cent, although this amount will vary somewhat. When this process is done commercially, the excess of chemical in the solution is separated after the process is accomplished, and is then used again. It can be said that the large use which has been made of this process of late has been instrumental in reducing the costs of operation and making it possible of application to a great many fabrics where the cost of doing it made it formerly impracticable. Of course, a large majority of products can be either mercerized in the yarn or in the cloth. Yarns are mercerized in two methods, the first being in a skein form where the skeins are placed on a sort of drum which is immersed in the solution

and wherein the drum prevents shrinking. The second method is to mercerize the yarn in a chain form, the machine employed making it possible to keep the yarn under tension while it is in the solution. Both of these processes were used quite extensively before the final decision was reached that the patents which had formerly been granted did not hold, although, naturally, few outside of the various plants knew they were being used. Recently, there has been a large increase in the sale of fabrics which are mercerized. These are of two kinds. The first is that class wherein soft or rather soft twist yarn is used as filling, and which is held tightly in the filling direction when it is mercerized; in other words, the

SOFT TWIST FILLING

is the portion of the cloth which receives the mercerization. The second class of fabrics is that which is composed of soft twist two-ply warp, and which is held tightly lengthwise of the fabric, and in which the warp yarn receives the luster. In the first class of cloths is the long list of shirtings, waistings and other rather fine fabrics, while in the second division are the mercerized poplins and similar fabrics, and in which list is included some kinds of draperies. A while ago it was believed that the process was of small value to any fabric which was produced from short staple cotton or from carded yarns, but recent events, notably the lowering of costs of operation and improvement in handling has made it of value in certain cheap cloths; that is, the cost of applying makes it possible to obtain a high enough price to warrant the process. The reason why longer staple cotton is used in many cases is because less twist can be applied to the yarn and still have enough strength to make the yarn usable. Longer staple cotton produces stronger yarn, because of the greater number of contact or friction points when it is spun. The small amount of twist is desirable in mercerization because it allows the fibres to lie more nearly parallel with a consequently higher luster. The increase of twist crinkles the fibre, and because the fibres are not straight, decreases the luster.

METHOD OF MAKING PATTERN.

In this identical cloth, the pattern is produced in the following manner: The black warp and black filling yarn weave plain throughout the whole fabric. Of course, this cloth has to be woven on a jacquard box loom, for two kinds of filling are used. This box-loom motion introduces two picks of black yarn and then two picks of mercerized yarn. When the figure is to be produced, the mercerized yarn is allowed to float and does not weave in with the black warp yarn. There is one point which is worthy of note, and which is probably done to allow the mercerized filling to spread as much as possible, and this is that one pick of black is placed in the same shade with the mercerized yarn, excepting where the figure is being woven. The mercerized yarn is woven two picks in a shade, and this process makes two picks of mercerized yarn and one pick of black yarn in a shade together, excepting where the figure is formed. It is also probably true that this cloth was woven face down in the loom, as by means of this process fewer hooks in the jacquard head are raised, and a better weaving job results. To produce the effect noted in the finished cloth there is employed a shearing process which clips off the floats of mercerized yarn which have been woven for the figure; that is, instead of having the cloth effect formed by the floats of mercerized yarn, it is formed by the black warp and filling which remain, and which have been woven plainly underneath the mercerized filling figure. It will be seen that this shearing process has not clipped off all of the filling floats. It is always a problem to make figures of this nature in this kind of fabric which can be sheared successfully, although the problem is much easier with filling floats than it is with warp floats. In very few cloths are the results entirely satisfactory unless the length of floats is from one-quarter to three-eighths of an inch in length, and even then, it often happens that threads are left on the cloth.

Of course, the result obtained is many times a question of price, for cloths can be sheared very closely indeed when the cloth price is of little consequence, but when a cheap fabric is being considered, an excessive price for the shearing operation would not be warranted by the selling prices obtained.

COST OF MAKING.

It is a quite well-known fact that the cost of making any kind of novelty fabric will vary greatly. In the first place, many makers have to purchase their entire supply of yarn when a special cloth is to be made. Then, too, certain mills can make ordinary dyed yarn but have no apparatus for mercerizing. Due to such conditions, it is very likely that the cost of materials makes the profit obtained by various manufacturers of widely different amounts, even if a good price be obtained for the cloth. One other reason why the cost of making such cloths will vary is because of the comparatively small size of orders received, when compared with many other cotton fabrics, and because most of the above lines are not regular ones, they are likely to be made in small mills where the costs of production are naturally high. Prices are, for the foregoing reasons, naturally steep for such fabrics when first sold, but this is a natural condition, and may not allow any excessive profits to the cloth maker. Retailers do surely obtain a much larger percentage of profit on all kinds of drapery fabrics than they do on many kinds of dress fabrics. This is claimed to be necessary because of the small turnover in the sale of such materials, but both cloth makers and cloth users often comment on the prices for fabrics of this character. One interesting item is that it is sometimes possible to purchase cloth of practically identical construction but sold in two different departments of the same store and at radically different prices, and this will tend to prove that selling methods do have a great deal of influence on the prices to consumers, and they have to be considered in the distribution of merchandise.

PATTERN.

40/1 Am. combed black $\frac{2}{10}$ 1,748 $\frac{2}{10}$ = 1,748 ends.

70/1 Am. combed black }
20/2 Eg. combed gold } Filling, 60 picks total per inch.

24 reed, 36" width in reed, 34¾" wide, finished.
50 × 60 finished count.

YARNS.

			Cotton.	Labor, waste, dyeing, etc.		
40/1 Am. combed black,	1⅛" sta.;	8 hank dou. rov.,	18c.	24½c.	=	42½c.
70/1 Am. combed black,	1⅜" sta.;	14 hank dou. rov.,	24c.	33½c.	=	57½c.
20/2 Eg. combed gold,	1⅜" sta.;	4 hank dou. rov.,	26c.	24¼c.	=	50¼c.

COST.

1,748 ends 40/1 Am. combed + 5% take-up	= .0547 @ 42½c.	=	$ .0233
30 picks 70/1 Am. combed	= .0183 @ 57½c.	=	.0105
30 picks 20/2 Eg. combed	= .1286 @ 50¼c.	=	.0646
Weaving			.0190
Expenses			.0198
Shearing, etc.			.0025
			$ .1397

Yards per pound, 4.96.
Retail price, 39c. per yard.

JACQUARD PATTERNS.

That every kind of cloth can be treated in a method which might be called different is not often realized in the cloth trade. Take this individual cloth, for example, and it can be seen that the painting of the jacquard design can be made much simpler than it would appear at first glance. It will be noted that the ground or black yarn weaves plain continually, so that for all the black filling only two different jacquard cards are necessary, as each two following black picks are duplicates of the preceding two. Because of the above reason, the cards for all the black picks can

be cut on a repeater and in a much shorter time than if done on the ordinary card cutter. Not only can the above process be adopted and these cards be introduced into their correct positions before the card set is laced up, but, in addition, the design can be laid out and painted, taking account only of the mercerized filling yarn. The design paper should be planned to apply correctly when this is done, but it is one of the means of reducing the cost. With the correct method, it is not even necessary to have the weave painted on the mercerized yarn ground, but the result can be produced by merely painting in the places where the filling floats or figure are produced. Methods of saving time in the painting of jacquard designs are in use in many forms, and these methods will vary according to the work being done. The adaptability of the man producing the work is of much influence in the easiest method being obtained, but unquestionably all the processes used do greatly help in lowering the cost.

To find the weights of the yarn and the yards per pound the process is as follows:

1,748 ends ÷ (840 × 40/1) = .0520, weight of warp without take-up.
5% take-up in weaving.
.0520 ÷ .95 = .0547, total weight of warp per yard of woven cloth.

$$\frac{30 \text{ picks} \times 36'' \text{ width in reed} \times 36''}{36''} = 1{,}080$$

yards of filling (both 70/1 and 20/2).
1,080 ÷ (840 × 70/1) = .0183, weight of 70/1 filling per yard of cloth.
1,080 ÷ (840 × 20/2) = .1286, weight of 20/2 filling per yard of cloth.
.0547 + .0183 + .1286 = .2016, total weight per yard.
1.0000 ÷ .2016 = 4.96 yards per pound.

SILK MIXTURE MARQUISETTE

This class of fabric has quite a general use and although not so large as many of the ordinary cloths, still it is of importance in cloth sales. Especially has this been true during the past few years, when light materials have been used as overdresses and for other purposes, which add to the attractiveness in the finished garment. It is probable that most of this cloth is made wholly from silk yarn, but it is also manufactured from silk and cotton and entirely from cotton. To make the open work desirable it is necessary to use yarns of small diameter, this being one of the reasons why silk is used and why most of the cotton cloths are of fine or comparatively fine yarns. In few cases is there any great attempt to finish the fabric so that there will be a large amount of luster, the

MAIN PURPOSE

being to obtain an open effect with a comparatively firm texture, that is, one which does not slip badly. Because the yarns are so fine and the count of the cloth so low, it is necessary to use a weave much different than that employed on most of the ordinary fabrics sold. This weave is generally called gauze and is the simplest form of leno weave used.

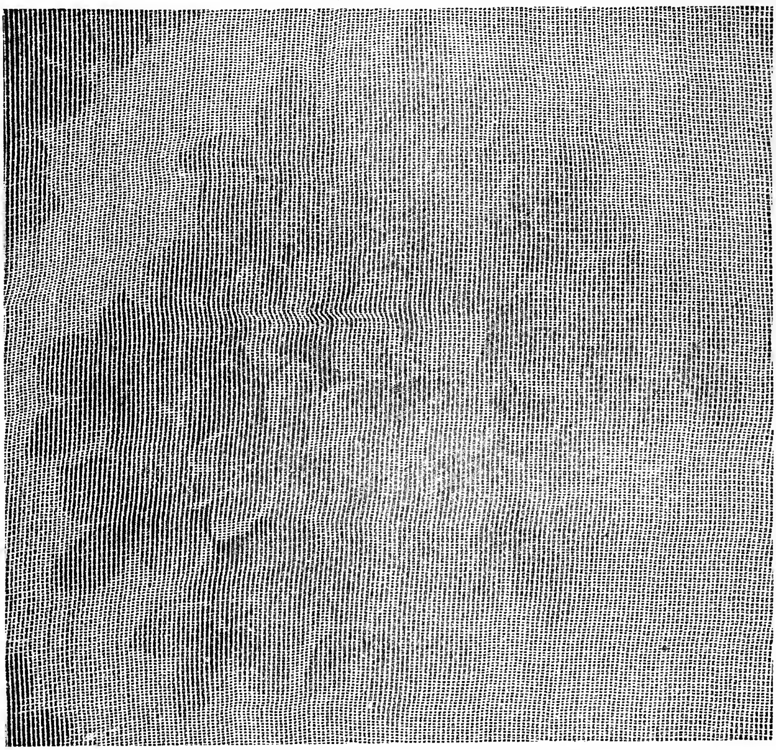
Inasmuch as the cloth analyzed takes the place of some of the more expensive articles, and because it has developed a field which neither all silk nor all cotton fills, it may be well to consider it in some detail. A few years ago quite large quantities of similar fabrics were made and sold, but they were generally dyed solid colors, while to-day fabrics are appearing which have printed patterns and which undoubtedly will have a large use because of their attractive appearance. Of course, it is admitted that the cloth as a fabric is not of much value, excepting when used with other materials, and thus the sale depends a great deal on style, much more so than when other fabrics are considered, but style to-day is of large influence in the use of any cloth, in fact, many believe it has more to do with successful operation and satisfactory profits than any other one item.

CLOTH CONSTRUCTION.

As previously stated, the weave is what is called plain gauze, or, where one thread crosses first to one side and then to the other side of another thread, usually called the ground thread. This process of weaving does not result in the threads lying parallel as in most cloths, but the threads twist around each other and through

this twisting the filling is held tightly and the warp does not slip even though there are no threads alongside to hold them in.

Cloth of this character is produced in different ways, sometimes the ordinary leno motion with doups is employed with operation from the bottom, while at other times special reeds are used, and it is also possible to use patented heddles which operate in a manner similar to the doups ordinarily seen. It is not necessary to place the crossing and ground threads on different beams, as is done in most kinds of leno work where changes are not regular and where the yarns are of different sizes, but, inasmuch as both threads are the same size and twist around each other, their take-ups and weaving are similar. It is, however, necessary to place the selvage ends on a separate beam or spool, because these ends do not take up in as great amounts as the ground part of the fabric.



Silk Mixture Marquisette.

The weaving take-up is generally small, because the yarns are fine and they do not have to bend very much through the introduction of the filling.

ANOTHER FEATURE

which has to be considered in planning any kind of an all-over leno

cloth is that comparatively few picks can be placed in the fabric. This is not because the filling yarn fills the spaces available, but because the warp threads take up a great deal of room in crossing back and forth, and for a certain size of yarn only a certain number of crossings can be made. For the above reason the actual cloth construction should be worked out at the mill, a few picks too low will produce a cloth which will slip, while a few picks too many will cause a bad weaving job and a large number of seconds. Much of the cloth made some time ago was woven with 60-2 warp and two-thread 32-38 Tussah filling. Because of the rubbing and strain on the yarn, it is customary to use two-ply warp of rather fine character. Too many picks of light silk filling are objectionable in that the fabric will not hold them, and the beating up of the reed is likely to cut them, making small places in the cloth, which appear as if the leno motion does not operate, and naturally very many of such places will create a second.

WEAVING.

Even to anyone not familiar with cloths or the making of them, the weaving of such a fabric would be expected to be the item of greatest interest not only because the fabric is different but because of a different method of producing. In the first place, it is easy enough to note that the two threads cross every pick to form the effect produced and that the whole fabric is nothing more nor less than the repetition of weave noted on these two threads. This can be seen from the illustration which we present. The leno or crossing threads are in solid color, while the ground threads are made of vertical lines and the filling is represented by the twill lines.

It will be noticed that the fabric ground does not weave together at all, for the ground threads are always depressed and the filling threads always pass over the top, the only way the threads are held together being through the crossing back and forth of the leno threads. Of course, the leno and ground threads cross each other and, inasmuch as the take-up on both of them is the same, they twist around each other in a similar manner, although for purposes of clearness we have not indicated them in this manner. The crossing thread is always on the top shed when the filling is introduced, while the ground thread is always depressed. To show how this above result is accomplished on the loom may not be so easy, although by referring to the illustration the process may be observed. The threads are first drawn through heddles on harnesses just as if ordinary plain cloth were to be made, the first thread on the first harness and the second thread on the second harness, this operation being repeated until the whole warp is drawn in.

There is, however, in front of these two harnesses a

REGULAR HARNESS

containing heddles, and also another slip harness containing no heddles. From the base of the first or slip harness are cords which pass up and through the eyes of the second harness heddles. Thus it will be seen that when the first harness or slip is raised, the cords are free to slide through the heddle eyes of the second, while, when the second is raised, the first is raised with it, because of the doups being through the eyes. Of course, if operated in this manner, there will be quite a strain on the cords, so an arrangement is usually made whereby the first harness is always raised when the second is, though the first can be raised when the second is not. One of the threads which has already been drawn on the back harness is again drawn through the cord loop which goes through the heddle eye, and when this has been done the other or ground thread is crossed over. The whole warp is then reeded and is now ready for the loom. although it must be recognized that crossing and ground threads must be drawn in the same dent in the reed or they will not operate.

OPERATION SIMPLE.

The operation of the loom is simple and is as follows: When the back

harness is raised the front harness, or the one containing the cords, is also raised, and the threads pull the cords through the heddle eyes, thus lifting the crossing thread on one side of the ground thread. At the same time the harness containing the ground thread is left down and the filling passes over this portion of the warp. On the next pick the back harness, which was raised on the first pick, is left down, together with the harness containing the ground warp; in other words, the whole warp is down as far as the plain back harnesses are concerned, but the first and second harnesses are raised, and, because the loop is held tightly in the heddle eye, the crossing thread is pulled around to the other side of the ground thread, thus bringing the opposite position from that noted on the previous pick. These two operations are continued throughout the cloth. To make the weaving easier and to relieve the strain on the yarn, a motion is applied to the back of the loom which lets off a certain amount of yarn when the crossing is taking place, but which pulls back the extra yarn when it is unnecessary.

A great deal of the success obtained when making a leno or gauze fabric depends upon the care with which the loom is set. Not only will the percentage of production be higher, together with a smaller number of seconds if care be exercised, but the cords or doups in the crossing motion will wear much longer and will make the cost of production less. Even at best, these cords wear out quite rapidly Another item which needs attention is to see that all the reeds used are in perfect condition, for if there be a few crooked dents, this will cause an open place in the cloth with the warp thread spaced irregularly, and which effect cannot be eradicated when the cloth is finished.

LOOMS OPERATED.

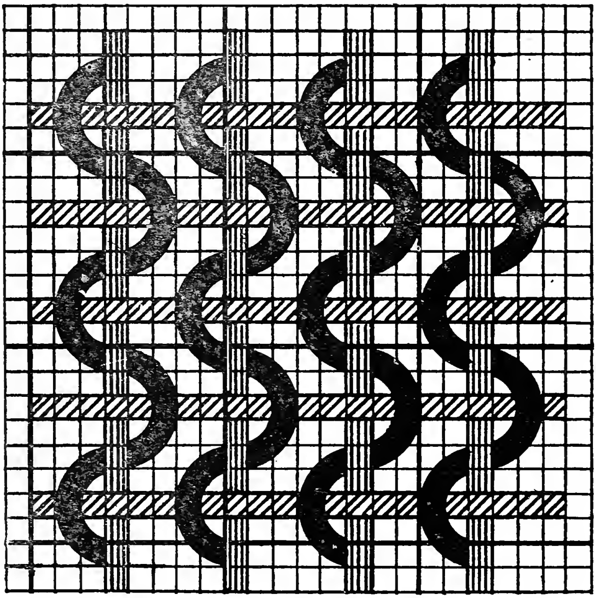
The question of operatives and production is one which requires much consideration when such a cloth is to be woven. As will be seen from the analysis, the weaving cost is high, and it forms a much larger share of the total cost than is the case on most fabrics. Anything which will permit an increased production should be tried, or it might be well to increase the looms per weaver, even if the percentage or production decreases somewhat, but this is not a good plan if the number of seconds increases radically. As style is responsible for a great portion of the use of such cloth, the quality made is largely instrumental in bringing good prices, and, therefore, this should be kept as high as possible. To show how much the cost is affected by the production, it can be said that a 5 per cent increase in loom production will mean a saving of 45 cents a yard in the cost, or a saving of 9 1-3 cents a pound in the cloth. Of this saving 35 cents a yard will be on the weaving alone, and, besides, with a greater production, a smaller amount per yard is needed for dividends. In other words, a 5 per cent increase will mean a saving of over $1 a loom per week and, with 100 looms operating, would be the same as saving the wages of more than 10 men at $10 a week. Just how far some of the cost systems in use are fundamentally wrong is illustrated well by the cloth being considered.

It often happens that to obtain the total cost a certain percentage is added to the weaving cost to obtain the expense cost. This method may give fairly satisfactory results where constructions do not change much and where looms per operative do not vary widely, but where constructions, yarns and methods of making are radically different for each fabric, the cost of making obtained in such a manner is obviously incorrect. The expenses per loom in most mills do not vary so widely as the cost of weaving, mainly because the expense items per loom are many of them fixed, while the percentage of production per loom and the looms per operative may be radically different on the various styles. The loom speed for leno cloth is not so high as it is for many other fancy woven fabrics; for it is necessary to have more time for the threads to cross satisfactorily. Even with this slower speed the percentage of loom production will be lower than it is on most fancy woven

fabrics and radically lower than it is on plain cloths.

PLANNING PRODUCTION.

Inasmuch as this kind of cloth is most always produced in cotton mills, and as long as the yardage produced from a pound of cotton is large, certain problems have to be considered when orders are taken. If a mill is planned to make the yarns used in weaving, and most of them are, it will be evident that when such cloths are being produced the spinning and accessory machinery, or a large portion of it, will be standing idle. Some do not consider this yarn making machinery when they are considering profits, but it is very evident that profits will not be so large as they have been figured, because the preparatory machinery expense will have to be carried by the looms, for instead of the spinning and other machinery making a profit, or even operating at cost, it will be losing money when standing idle. If cloth prices are to be made with this machinery standing idle there should be sufficient leeway to permit of a satisfactory profit on all of the machines in the plant. Of course, quite a few mills sell yarn when their looms are operating on novelty fabrics for which yarn must be purchased, or in which little material is required. This can be done successfully if the styles do not change rapidly, for prices on sale yarn can be made as low as cost, and even then a mill is at some advantage because the organization is being held together. The selling of cloths which keep all or nearly all of a mill's machinery in operation requires a great deal of judgment and is one of the items which, up to the present time, has been neglected, but better training and more accurate records are making the problem much simpler than it was, and without doubt this



Weave.

policy is saving money for some mills making novelty cloths.

METHOD OF FINISHING.

There is nothing in the finishing of such a fabric as that analyzed which is particularly troublesome, excepting that the cloth is of rather light weight and not very strong, and, therefore, must be handled carefully. As the cloth is composed of silk and cotton, it must be bleached in the usual method employed for the combinations of these materials. When the fabric has been bleached it is sometimes dyed a solid color with a dyestuff which requires only one bath, while at other times it is dyed in two colors, and through the means of two processes, the silk being dyed with one kind of color while the cotton remains white, and a subsequent process makes the cotton the desired color. The fabric we have considered has been bleached, but instead of being dyed, it is printed, the patterns being no different than those applied ordinarily to light cottons, or silk and cottons used for dress purposes. The colors are usually light shades, and because of the open work of the fabric the effect is rather subdued, appearing somewhat similar to many printed warp fabrics which are often produced in silk and at certain times in cotton.

It is usually the purpose when finishing such fabrics to have a large share of the ground cloth with plain effects, so that the underdress may be partially visible, the patterns being added more for attractiveness in general effects than for any other purpose. Few realize the number of high quality fabrics now being produced in domestic mills and the adaptability which is being used in making them desirable from a consumers' standpoint. It is such improvement and adaptability which is going to make the future of the domestic industry certain, and when consideration is given to the amount of progress made during the past five years the situation is truly one in which domestic sellers may well take pride.

PATTERN.

100/2 Sea Island combed		1,408		= 1,408
100/2 Sea Island combed	$\frac{2}{32}$		$\frac{2}{32}$	= 128
				1,536 total ends.

14/16 2 thread Canton silk filling, 44 picks.
50 reed, 29" width in reed, 26" grey width, 25¾" finished width.
56 × 44 ground count finished.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.	
100/2 Sea Island combed, 1⅝" sta.; 20 hank dou. rov.,	32c.	42c.	8c.	= $ .82
14/16 2 thread silk, 140,000 yards per lb., on quills,				= 3.75

COST.

1,408 ends 100/2 Sea Island combed..........+ 7% take-up	= .0360	@ $ .82	= $ .0295
128 ends 100/2 Sea Island combed..........+ 2% take-up	= .0031	@ .82	= .0026
44 picks 14/16 2 thread Canton..........................	= .0091	@ 3.75	= .0341
Weaving			.0534
Expenses			.0140
			$ .1336
Selling			.0027
			$ .1363
Mill selling price, (about)..........................			.1525
Finishing, printing, etc..........................			.0300
Converter's cost (without expenses)..........................			$ .1825
Price to retailer (about)..........................			$ .2600
Price to consumer			.3800

All over leno weave, changing every pick.
Yards per pound, 20.75 (grey).

CLOTH WEIGHTS.

Fabrics such as that considered are usually sold by the mill in a grey or unfinished state, that is, they are made f grey or unbleached cotton, and the cloth appearance is, many times, nothing like that which it is

when sold over the counter. For this reason the weights and yarns are given in their grey state. Take the warp in this cloth, and without doubt the size when used was 100-2, but as it stands in the finished cloth, the size is nearer 110-2. This finer size comes from the handling and fulling of the cloth and from washing and bleaching. The silk filling used was probably two-thread 14-16 Canton silk. We have used in our analysis a yardage of 140,000 for this silk, although this is not the theoretical yardage, but is one which is somewhat lower, and is a sort of protection to the cloth maker for variation in size. It must be remembered that when the cloth is bleached and boiled out this silk will lose a varying amount through loss of gum, the loss differing according to conditions of finishing, though it is probable the percentage would be from 15 to 20 per cent. When the yarn sizes have been obtained and the take-up in weaving noted, the problem of finding the weights of the yarn, and from these weights the yards per pound, is easily accomplished, and is as follows:

1,408 ends $\div$ (100/2 $\times$ 840) = .0335, weight of ground warp without take-up.
7% take-up in weaving.
.0335 $\div$ .93 = .0360, total ground warp weight per yard of cloth.
128 ends $\div$ (100/2 $\times$ 840) = .0030, weight of selvage yarn without take-up.
2% take-up in weaving.
.0030 $\div$ .98 = .0031, total selvage weight per yard of cloth.

$$\frac{44 \text{ picks} \times 29'' \text{ reed width} \times 36''}{36''} = 1{,}276 \text{ yds.}$$

of filling per yard of cloth.
1,276 $\div$ 140,000 yards silk = .0091, total weight of filling per yard of cloth.
.0360 + .0031 + .0091 = .0482, total weight per yard.
1.0000 $\div$ .0482 = 20.75 yards per pound.

SILK MIXTURE BROCADE

There has been a great deal of interest during the past year or more regarding the sale of fabrics composed of silk and cotton. Various causes contributed to a large slump in the purchasing of these cloths during the past year, and while many believed there was to be only a small demand for them some time, a great many others were convinced that such cloths when made in good quality would have a good sale. It can be said that fabrics of this character are available for certain uses, and that they fill a place which neither all cotton nor all silk can. This results from the fact that material wholly made of silk is rather expensive and when fabrics are made entirely of cotton they do not have the effect desired by a great many consumers, therefore the combination of materials makes a cloth which offers quite a good deal of value and an effect which many times would be considered as being produced from silk entirely. Naturally, the large majority of such materials are rather light in weight and they are used for dresses, waists and almost any other purpose where a light cloth is suitable and where a great deal of hard wear is not encountered.

REGARDING DEVELOPMENT.

Fabrics made of these materials are liable to be very ragged looking if the construction is poor, and this is the main reason why there was a slackening in demand. There is no reason why there should not be a continued and satisfactory demand for fabrics of this nature, and without doubt the next few years will see a good many of them used.

Inasmuch as these cloths have not been made and sold in large quantities for any length of time, it may be well to state a few facts regarding their making. In a general way it can be said that the large use of fabrics of this character has grown during the past ten years, although they were manufactured quite a while before this time. When first produced the combinations were of rather unknown quantity and the results not always satisfactory, but in time beautiful results were produced. It is only within the past five years that the cloth finishing process has improved to such a great extent as it has. Of course, before this time the cloth was finished in a satisfactory manner, but the appearance has been greatly improved since that time.

PRICES WERE HIGH.

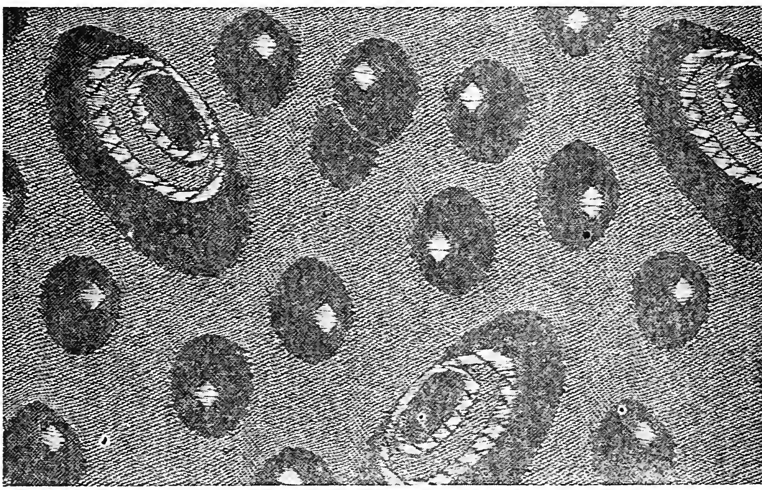
When these fabrics were first produced the prices were very high at

retail, probably because of their similarity to silk fabrics. At that time it was possible to see fabrics of this character selling at anywhere from 75 cents to one dollar or even more per yard, and which can now be purchased at from 25 to 35 cents per yard. This has come about largely because of the greater amount of competition in the making of such cloths, for there has been a big increase in competition in the domestic market during the past ten years on fine and fancy fabrics. In some classes of these materials silk is used for the warp yarn and cotton for the filling yarn, while in other instances cotton warp is used together with silk filling. In the first class of fabrics are silk and cotton eoliennes, poplins, crepes and some other materials, while in the second class are the so-called Canton silks of various kinds.

When silk warp is used it is the custom to use Italian silk for the warp. The size of yarn used will vary somewhat, depending upon the conditions in the different mills, some mills being able to use finer yarns than others, although the variation is comparatively small. When silk filling is used it is ordinarily either 14-16 two-thread Canton or else 22-26 single Canton. The latter size silk is somewhat finer than the former and is used in the cheaper grade of material. The foregoing statements do not mean that other silks are not used in making silk and cotton mixtures, but by far the largest quantities are the silks named.

PERCENTAGE OF PRODUCTION.

Fabrics of this character are made in well-equipped mills, as a usual thing. That is, they have looms that can handle silk and fine cotton yarns, for it is generally necessary to use fine cotton in combination with silk to give a fabric which is suitable. A great many manufacturers were afraid to go into the use of silk, because they thought it would create a great deal of trouble in weaving. Continued attempts have proved that such was not the case, because in a majority of the instances a greater percentage of production is obtained than if a whole cotton cloth were being made. In fabrics which are of good quality and made by combinations of these materials it is usually the case that the



Silk Mixture Brocade.

silk costs will about equal one-half the total cost of the cloth, including the labor and cotton yarn charges and expenses. The effects which can be produced are many times very beautiful, and the silk tends to bring out the weave to a greater extent than if cotton alone were used.

The percentage of production will depend a great deal on circumstances, but under the right conditions no trouble should be experienced. If the reeds are poor and silk warp is being used the roughness will rub the yarn and cause many breakages, besides making an uneven cloth. It is also true that rough heddles or cracked heddle eyes will cause breakages in the warp if silk be used. Because of the fineness of the silk filling it is not so necessary to change bobbins as if cotton yarn were being used for rough filling. In most instances the filling is purchased on quills and ready to use in the shuttle, although there are mills which purchase the silk on spools and quill it themselves.

THE ORGANIZATION.

One of the most important, if not the most important, item in connection with making cloth of this character is the relation which the production bears to the machinery equipment in the mill. It would be a rather foolish process to have a mill entirely equipped for producing cotton cloth and then to start in making fabrics of this nature and have quite a large share of the machinery idle as a result. Some mills when making cloth of this nature sell yarn, and this keeps their extra machinery in operation, and while sometimes not returning a profit it keeps the organization at the mill intact, or until cotton cloths are more desirable. Cases have been known where yarn production was sold and where mixture novelties were woven to take care of the looms and keep the weavers. Prices were made in this instance at low levels to obtain a sufficient quantity of orders.

Silk mills object to selling silk on spools in some cases, largely because if the silk is sold in this manner it keeps their filling machinery idle and their organization is planned to produce the silk on quills. Of course, if the profit in making cloth of this character is high enough to warrant the carrying of the overhead charges when the rest of the plant is idle it is a different proposition, but there is always the item of keeping in touch with customers and keeping operatives employed, and that these are of great importance is being shown very clearly in to-day's manufacturing.

LOOMS USED.

Inasmuch as these cloths represent some of the finest productions in the domestic market, it can be said that they are made in the newer and better equipped plants. In a general way these fabrics are made on dobby and jacquard looms, although there are quite a good many which are produced on plain looms. Many of the dobby patterns are made on looms which operate up to 24 harnesses, and probably most of the jacquard patterns are made on either 400 or 600 head machines. This does not signify that the count of these machines is the same in very many instances, because the tie-up will vary. Most of these jacquard looms were installed to make shirting materials and in few cases is the tie-up per inch over 120, while in many instances, it is lower than this amount.

Probably the largest amount of cloth produced with any one warp count is that made with a count of 96 threads, and the number of picks will vary, depending on the price paid and other conditions. As a usual thing when the warp count is the above amount, the size of yarn used is 60-1. Fabrics wherein silk is used for warp or filling are generally of narrow width, although during the past year or so there has been an increase in the amount of wider cloths made. It may be well to make mention of the fact that most of the ground weaves where patterns are made are plain weaves. This is done because it makes a firmer ground and makes it less necessary to have a high count. As there is a large sale at present for silk brocades there has been a line of fabrics brought out to imitate them, which are called silk and cot-

ton brocades. These have a satin ground in which the filling floats, giving an appearance very similar to many all-silk fabrics. Because the ground weave is satin it is necessary to have the cloth count higher than if the cloth weave is plain. This will be noted when it is pointed out that the count on this fabric is 112 x 116 in the grey state. The weaves used are very simple, although the effect is quite striking, due to the contrasting colors.

CLOTHS DETAILS.

The fabric we have analyzed is of course made on a jacquard machine, and it may be well to give a few facts regarding its construction. The loom on which this cloth was made is called a 400-jacquard. In this machine there are eight hooks in a row and 50 rows in the head. Without doubt it was made on a double lift machine which contains actually 800 hooks, but there are two hooks which operate on each neck cord and which allow the loom to be operated at a faster speed than would otherwise be possible. Even though there are 800 hooks in the machine it actually works as a 400-head. The machine is tied up in the comber board 120 threads per inch, giving 3 1-3 inches, the width of the tie-up in the comber board:

400 ÷ 120 = 3⅓", width of tie-up.

In making this cloth a 54-reed was undoubtedly used. This gives the number of dents in the reed as 180:

54 reed × 3⅓" = 180 dents.
180 dents × 2 ends in a dent = 360 ends in the repeat, or 360 hooks to use.
400 hooks — 360 hooks = 40 hooks cast out.
40 hooks ÷ 8 hooks in a row = 5 rows cast out.

There are various methods of casting out hooks not used in making a cloth, but where there are so few cast out as in the present instance it does not make very much difference where they are cast out, although it can be said that it is better to cast out more than two or three rows in any one place, and to make it more convenient in cutting the cards it is better to cast them out at the end of each half machine, that is, to cast out the 24th and 25th row in the first half of the machine, and the 48th, 49th and 50th rows in the last half of the machine.

There is another item which sometimes is of importance, but which in this cloth makes little difference. This relates to the spacing of the warp in the comber board. To make a warp run as well as possible it is always best to balance the cloth in the machine. Inasmuch as there are 2,876 ends in the warp, not including the selvage, as these are operated separately from the main warp, the process is as follows:

2,876 ÷ 360 ends in the repeat = 7 sections + 356 ends.

Assuming that the jacquard is tied up 40 inches wide this gives 12 sections at 3 1-3 inches each. Then we have

12 sections — (7 sections + 356 ends) = 4 sections + 4 ends.

Therefore, to space the warp in the proper position two sections and two ends could be left out on each side of the warp, or, in other words, if the warp be started on the second hook in the third section the spacing would be as nearly correct as possible. Naturally, the warp would end up two hooks before the last hook to be used on the tenth section. As stated previously, this does not make very much difference when the patterns are all-over ones, but where stripes are used, either in color or in the white state, patterns should be balanced as carefully as they are when making dobby patterns. This is not always done, but when it is done it is sometimes an aid in selling the cloth, as it gives a better balanced appearance.

DESIGN MAKING.

For all patterns similar to that used on the sample analyzed it is necessary to make up a jacquard design. This is done in a number of methods to suit the needs of the situation, but the usual method is as follows: In the first place a cloth sketch is made up with the figures painted so as to show the effect desired when finished. This cloth sketch represents the de-

sign in the finished cloth and is usually made the width of the finished pattern. From this cloth sketch the design is enlarged and placed on design or point paper. This is done by enlargement. In the first place the design for this cloth would be ruled up into 45 square inches in the warp direction, each small square representing one large square in the design paper, and when this has been done the outlines of the patterns are transferred. The design paper is usually made to correspond with the cloth count, but each square in the warp must be ruled off in eighths to correspond with the eight hooks in a row which the machine contains.

When the outline has been transferred the weave is painted in either by the one who transfers the pattern or by another party. This is not a very intricate process on such a cloth as the one analyzed, although the effect depends somewhat on the carefulness employed in making the various weaves join. It is, however, a tedious undertaking and consumes quite a little time. Sometimes where satin weave grounds are employed the design paper already has a satin weave dotted in, and this makes it unnecessary to paint in the ground weave. When the design has been painted in, it is given to the card cutter. This operative cuts the weave upon a card, which operates the hooks of the jacquard head. Each card represents one pick, and each square in the design paper represents one hook in the machine, and each large square in the design paper represents one row in

THE JACQUARD HEAD.

When the cards are all cut the number is equal to the number of picks of the pattern as painted. These cards are taken to a card lacing machine. This machine laces them together in a continuous manner, so that they follow one another on the cylinder of the jacquard head when in operation. This completes the process and the operation of the hooks in the machine by the cards as punched will produce the pattern. This sample set of cards is usually operated in producing a sample piece of cloth. When an order is obtained it is customary to use quite a number of looms in making and this necessitates a number of sets of cards, one for each loom. These are produced on what is called a card repeater. This machine is no more nor less than a card-cutting machine on which the sample set of cards are placed and wherein a whole duplicate card is cut at once instead of cutting a row at once, as is done on the original card cutter, and this saves quite a little time and lowers the cost. These machines are practically always used when mills are of any size.

METHODS OF FINISHING.

It may be well to mention the fact that the finishing of these silk and cotton cloths has improved quite a good deal in the last few years, and this makes them all the more desirable in their field. Of late it has become a general practice to use fast colored cotton yarn for making stripes, cords, and checks, and these additions improve the cloth appearance a great deal and make a larger sale possible. Before fast colors were in use colors could not be used to any extent, because practically all these cloths are woven in the grey and bleached after the cloth is woven. There are very many methods of finishing these fabrics. Probably most of them are dyed in solid colors, these colors changing from season to season, depending on the demand. They are also finished in a white state, and some seasons they are sold with various printed patterns upon them, which in many cases add to their attractiveness and aid in the sale. These cloths are also cross dyed. This is possible because silk and cotton can be dyed in different methods. Certain colors which are attracted to cotton will not affect silk, and vice versa.

In this manner it is possible to dye cotton one color and silk another, or it is possible to dye cotton one color and leave the silk in a pure white state. This has been done with the sample analyzed. The cotton has been dyed black while the silk remains white, making the two yarns show a great contrast. This process is being

adopted not only in silk and cotton fabrics, where there is all-silk warp or filling, but also where there are stripes or checks in silk, such as voiles and poplins. Without doubt, the increase in ingenuity in methods of making cloth attractive by the finishing and dyeing processes has had much to do with the increase in sale of high-class novelty fabrics.

CLOTH AND YARN WEIGHTS.

It may be interesting to know the process for obtaining the weight of the yarns and of the cloth. The weight as figured is for the cloth as it comes from the loom and not for it in a finished state. When finished the cloth is quite a good deal lighter than when woven. This occurs because the warp yarn loses in the finishing process, and the silk filling loses a certain percentage of gum which it contained when it is used in the loom. The yardage of the silk as used is not that which might be called theoretical, but it is one which is used as a protection against variation in size by the manufacturer, and is most always somewhat heavier than the yarn is likely to be. Inasmuch as the silk filling yarn cost is such a large percentage of the total cloth cost, any great variation in the price of this material will affect that of the cloth quite a little. The price we have given was the market price at one time, but it has been increasing quite rapidly. The method of finding the various weights is as follows:

2,956 ends ÷ (60/1 × 840) = .0586, warp weight without take-up.
4% take-up in weaving.
.0586 ÷ .96 = .0610, total weight of 60/1 in 1 yard of woven cloth.

$$\frac{116 \text{ picks} \times 27'' \text{ reed width} \times 36''}{36''} = 3,132$$

yards of filling per yard of cloth.
3,132 ÷ 140,000 yards = .0224, weight of silk filling per yard of cloth.
.0610 + .0224 = .0834, total weight per yard.
1.0000 ÷ .0834 = 11.99 yards per pound.

PATTERN.

60/1 Am. combed warp, 2,956 ends.
14/16 2-thread Canton silk filling, 116 picks.
54 reed, 27" width in reed, 26" grey width, 25¾" finished width.
112 × 116, grey count, 113 × 112, finished count.

YARNS.

	Cotton.	Labor, waste, etc.	
60/1 Am. combed, 1⅜" sta.; 12 hank dou. rov.,	24c.	16½c.	= 40½c.
14/16 2-thread Canton silk, 140,000 yards per lb., on quills			= $3.65

COST.

2,956 ends 60/1 Am. combed + 4% take-up = .0610 @ 40½c.	= $ .0247
116 picks 14/16 2-thread Canton silk = .0224 @ $3.65	= .0818
Weaving	.0204
Expenses	.0278
Jacquard cards	.0021
	$ .1568
Selling	.0031
	$ .1599
Price to converter (about)	.1700
Finishing, etc.	.0250
Cost to converter	$ .1950
Price to retailer (about)	$ .2750

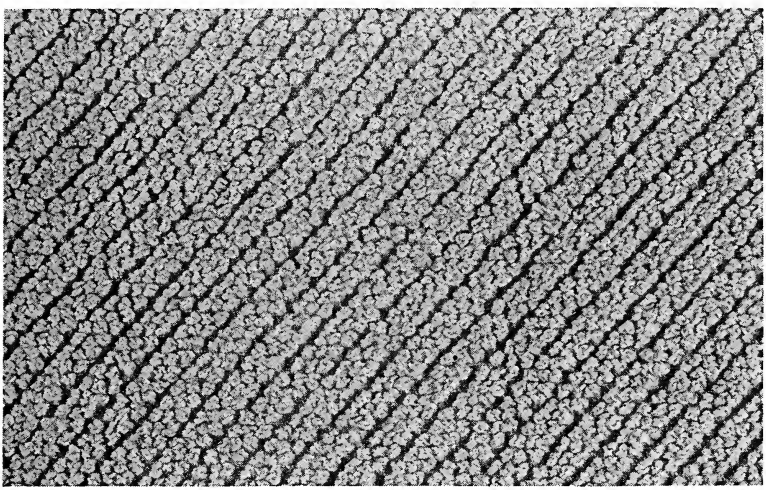
Price to consumer, 40c.
Yards per pound, 11.99 (grey).

DIAGONAL WEAVE TERRY CLOTH

During the past year or so there has been a great increase in the number of novelty fabrics of various descriptions which have been used for dress goods. This use has been a growth and has taken quite a time to become as large as it is, for it has affected all materials to a greater or less extent. Few have realized until recently just how large this use has been, but the recent showings of new fabrics for next summer's use by the large retailers have only served to accentuate the situation. Most of the fabrics which have a run as large as

eponge, and this includes all the cloths of a similar nature, have to be made better or different continually until there is no longer a sale for them.

When these cloths were first produced, anything which had a semblance of novelty yarn in its construction was sold and at a high profit, but as time went on, more of such cloths were sold and the prices were less reasonable, and to make the fabrics attractive they had to be made in patterns or in combination with the other one. It can be said that the cloth analyzed shows as great a difference between the cost of making and the retail selling price as any fabric which has been seen in years. That retailers expect quite a large sale is shown by the large quantity and the varied colorings which they are offering on this fabric. The cloth has a very attractive appearance and is well made, and the colors are the ones which should have a sale, but the price of the cloth shows as high a profit from its style



Diagonal Weave Terry Cloth.

other good selling materials. Most of the cloths which are now being shown contain novelty yarns, but they are used in some kind of a pattern with other cloths, such as crepes and voiles, or dyed in such a manner that they show quite a radical difference over those formerly sold.

One fabric which shows a combination of ideas is the one which we have illustrated. This fabric contains the terry cloth idea and is made in a better constructed fabric than is usually seen, and inasmuch as diagonals in the cut form have been in large demand in woolen fabrics, this cloth contains this idea together with exclusiveness, and as little profit from its actual cloth value, as any which have appeared recently.

CLOTH CONSTRUCTION.

In many respects this fabric is no different from the ones used for ordinary Turkish towels. The yarns are of somewhat different sizes and the cloth construction is changed so as to be more suitable for dress goods, but the general effect is that seen in the above-named fabrics. Combed yarns have been used in the cloth, and the right combinations of yarns and the correct amount of twist have been

given to produce a cloth which has the soft feel noted in the fabric analyzed.

Terry cloths are, ordinarily, produced on special looms, which can make them easily and cheaply, but this cloth was not made in this manner. In making an ordinary towel, the weave is such that a loose warp is bound into the threads, and by an arrangement of the reed or warp an open space is left in the fabric, and then the few picks, together with extra yarn, are pushed on into the cloth, making the loops ordinarily noted. The same general idea has been used in making this cloth, excepting that a different loom is used in weaving, one which weaves a wire into the cloth over which the loops pass and then the wire is drawn out, leaving the loops fast in the fabric. This method of weaving makes a somewhat better fabric and can be distinguished easily by examining the cloth carefully.

On an ordinary terry cloth the loop will be forced to that side of the cloth necessary through the filling underneath it, that is, a loop will not go down through the fabric if the filling underneath forces it to the face. In this cloth the picks, which are wires, are designated on the right hand side of the design, and where the loops are on the face are indicated by the squares being filled in. It will be noticed that the loop yarn is on the back of the cloth, both before and after the loop is formed, and unless held up by the weaving of wire, or in some other similar method, the loop would go, if made in the ordinary terry manner, to the back of the fabric. The twill or diagonal is formed by having one thread out of four in the loop yarn remain down in successive steps across the fabric. The take-up on this loop yarn varies a great deal when fancy figures are being woven, and, therefore, each thread often has to have a different spool or holder. This policy is taken when making carpets, and this fabric is no different from many carpet fabrics, excepting that the weave is very simple in comparison, and because the weave is simple the loop yarn can be placed on a single beam, or, if a single beam causes trouble, at most only four loop beams are necessary.

WEAVE.

It will be noted that the ground yarn, that is, the warp which forms the base of the fabric, and the filling which weaves in with it are of comparatively fine sizes in comparison with the loop yarn. This is done so as to give a rather heavy appearing face with rather stiff loops and the full effect which is so desirable. As we have previously stated, the lines to the right of the design indicate where wires are placed in the cloth, which are afterward removed, while the lines at the top of the design indicate which threads are the loop yarn. This yarn is drawn in two-ply and is equal to ordinary 6-1. It will be noticed that the ground threads and picks all weave plain. There are three threads between each thread of loop yarn, and if the loop yarn is removed from the fabric it will be found that absolutely nothing remains but plain cloth composed of 35-1 warp and 40-1 filling, although, of course, there will be open spaces where the loop yarn was removed. The weave, however, will join and be the ordinary plain fabric.

So far as the actual weave in the cloth is concerned, if it be picked out, it will be that with the fourth, eighth, 12th and 16th picks in our weave removed, for in the cloth as it stands there is no pick underneath this loop and, therefore, it would not appear. To produce this fabric the number of harnesses needed will be comparatively few, because the ground is nothing but plain weave and would take only four harnesses, while the loop threads repeat on four harnesses, thus the fabric could be produced on an ordinary dobby attachment.

An effect very similar to this idea might be produced on an ordinary towel loom if the same construction were used, although the weave would have to be slightly different to throw the loops onto the surface in the same positions as those noted on the cloth analyzed. Possibly, the resulting effect might not be quite so satisfac-

tory, but it would be so near the one analyzed that the ordinary consumer could hardly detect the difference, especially if intelligence were used in getting up the cloth construction.

CLOTH PRICE.

We have already made mention of the cost of production and the present selling price, and have stated that the difference between the cost and the selling price is about as wide as ever noted. As any fabric cost is based fundamentally on the yarn prices, an ordinary mill would not have a cost for yarn differing very much from that which we have given. In our weaving cost and expenses we have used conservative amounts and ones which should be noted on making a cloth of this character. The looms per weaver are fewer, the loom speed in picks per minute is less, while the percentage of production is somewhat smaller than for ordinary fabrics, although it should be higher than for most, if not practically all of the fabrics made in which wires are used. Then, in addition to the above facts, is the one that the picks per inch are actually quite a little higher than the number given in our analysis would indicate, due to the placing of wires in the cloth.

All these facts have been considered in arriving at the price for weaving and expenses. In no case should the total cost of making in the grey state be over 21 or 22 cents, even if made in very small quantities and in an extravagant manner. The cost of finishing should also be comparatively small, because many ordinary toweling fabrics which have been bleached, dyed and sold recently in the domestic market have been finished for less than 2 cents per yard, and it is unlikely that this fabric costs much more than this amount, although we have been conservative in the amount added for finishing.

Even if a mill sold this fabric in the grey state for 25 cents per yard, a very large profit would be secured, because the total number of picks is comparatively small and the loom production in yards must be quite large. The fabric was probably sold in the grey state and finished by a converter, because it is a piece-dyed fabric.

Without any question, the retail selling price on this fabric is at least from 10 to 12 times the cost of production, including the dyeing and finishing and cloth makers' profits. Such a fabric as this, and one showing as great a difference between cost of making and selling price, can be produced in other methods than by the use of wires or on the terry cloth principals.

This fabric can easily be woven on an ordinary dobby loom. Whenever a loop is desired, a heavy silk cord can be introduced into the cloth, and then, before the cloth is finished and dyed, it can be run into a bath of caustic, and this silk yarn will be eaten out, leaving the loops in a similar manner to those noted in the cloth analyzed. Silk for this purpose, if used in a fabric constructed as that analyzed, would not cost over 20 cents per yard, and, what is more, the weaving price per yard, if silk were used in this manner on an ordinary dobby loom, would be likely to be less than the amount we have allowed for the weaving price for this cloth. Of course, silk could not be used if the retail price and other selling prices were not so high, but without doubt for 50 cents per yard this fabric could be made in just as satisfactory a manner as the one considered and show quite a little profit to the manufacturer. Another method would be to use a smooth cotton yarn and a rather loose tension on the loop yarn warp, and when the cloth was woven to have operatives pull out the cotton threads which held up the loops.

Even this extra cost would not nearly equal the 20 cents per yard, if silk were used to make the loops. This is one subject which the

AMERICAN MANUFACTURER

has entirely neglected in the march of progress. He does not feel inclined to go into the making of novelty cloth to as great an extent as the European manufacturers and confines himself to the fabrics which can be produced in large quantities, making his profits through the small profits per yard on large quantities rather than on the large profits per yard on small quantities.

The American cotton cloth industry has progressed so rapidly that there has been a decided shortage of men capable of using their brains in developing new fabrics which show a decided difference from those ordinarily produced, and the men who have this ability are in such demand with the large cloth makers that they have been better off financially to apply their energy in this direction, rather than in working for themselves in a small way. The time is coming, however, when much of this work will be done in American mills by American manufacturers, and if their improvement in lowering cost on ordinary plain and fancy fabrics is to be taken as any indication of the future, it is very likely that they will soon be beating the world not only in style but also in price.

CLOTH WIDTHS.

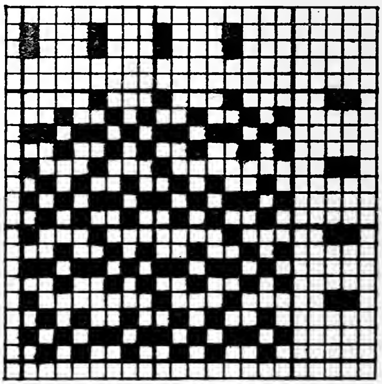
One matter which deserves notice is that concerning the cloth widths on imported fancy fabrics. It is seldom that the width of any imported fancy cloth is less than 40 inches, and most of them are from 45 to 50 inches in the finished state. American fancy cloths are more often from 25 to 28 inches wide in the finished state. Of course, shirtings and some other lines are from 31 to 36 inches wide finished, but they are not the so-called fancy fabrics in many instances. It is believed that American buyers have been largely responsible for the tendency which has developed fancy cloths in narrow widths, and set prices have probably been at the bottom of the custom. If the price of making advances for any reason in fancy fabrics is considered too high, the buyer is likely to ask for a cloth of an inch or so narrower width, and this may bring it within his range of prices.

We have often seen a new fabric offered to buyers at a certain price for a certain width, and because it did not come within his price range and still was a desirable fabric, he would have it made up an inch or so narrower, and then purchase. All the time the buyer does not realize that he is losing money, and as consumers have to purchase the fabrics which are offered to them, they also do not realize that there is a large waste in economy. This occurs because most fancy mills can make fabrics in the grey state at least 36 inches wide, and many of them will finish about the same width. As a usual thing the price paid for weaving and the expenses per loom are no different per yard for a 36-inch cloth than they are for a 27 or 28 inch one.

In certain mills where

COLORED FABRICS

are woven, there is a different scale of prices for weaving different widths of cloth, but this generally is not true for grey cloths. Often a slight difference in percentage of production is allowed in figuring a weaver's wages when a wide cloth is to be woven, but a buyer will obtain a 36-inch fabric at fully 25 per cent less cost for weaving and expenses than on the narrower fabrics. In other words, the extra cost of the wider fabric will include practically nothing but the extra cost due to the extra material for producing the wider width. European manufacturers found this out quite a while ago, and it is surprising that more American manufacturers have not brought it to the buyers' attention, with a consequent saving in profits to themselves and to consumers.



Weave Plan.

CLOTH WEIGHT.

It will be readily recognized that the analysis of the fabric such as

the one considered must be somewhat different than that of ordinary fabrics. In the first place, the obtaining of the yarn sizes is accomplished in exactly the same manner as that of an ordinary plain fabric. Where the difference occurs is in the take-ups on the various yarns. Of course, the loop yarn will have a large take-up, and the correct basis for estimating these take-ups must be used. Some sellers are accustomed to use a take-up by adding a certain percentage over 100 per cent to the yarn, but when the take-ups are as large as they are in a fabric of this character, the results are absolutely incorrect. The original length of the yarn should be considered 100 per cent, and the take-up shou'd be the diff:rence between the original length and the resulting length of cloth into which it is woven. On such a basis, results cannot be very inaccurate, and under such a basis, we have obtained the following results:

2,115 ends ÷ (35/1 × 840) = .0719, weight of 35/1 warp without take-up.
16% take-up in weaving.
.0719 ÷ .84 = .0856, total weight of 35/1 warp per yard of cloth.
1,408 ends ÷ (24/2 × 840) = .1397, weight of 24/2 warp without take-up.
60% take-up in weaving.
.1397 ÷ .40 = .3492, total weight of 24/2 warp per yard of cloth.
128 ends ÷ (50/2 × 840) = .0061, weight of 50/2 warp without take-up.
6% take-up in weaving.
.0061 ÷ .94 = .0065, total weight of 50/2 warp per yard of cloth.

$$\frac{44 \text{ picks} \times 48'' \text{ reed width} \times 36''}{36''} = 2{,}112$$

yards of filling per yard of cloth.
2,112 ÷ (40/1 × 840) = .0629, total weight of 40/1 filling per yard of cloth.
.0856 + .3492 + .0065 + .0629 = .5042, total weight per yard.
1.0000 ÷ .5042 = 1.98 yards per pound (grey).

PATTERN.

35/1 Am. combed warp...........		3		3		=	2,115
24/2 Am. combed warp...........			2 / 1			=	1,408
50/2 Am. combed warp...........	2 / 32				2 / 32	=	128
		704 X					3,651

40/1 Am. combed filling, 44 picks per inch.
30 reed, 48" width in reed, 42½" finished width.
85 × 46 all over finished count.

YARNS.

			Cotton.	Labor, waste, etc.	Twisting.	
35/1 Am. combed warp, 1⅛"	sta.; 7	hank dou. rov.,	16c.	11c.		= 27c.
24/2 Am. combed warp, 1⅛"	sta.; 5	hank dou. rov.,	16c.	8½c.	1¼c.	= 25¾c.
50/2 Am. combed warp, 1 3-16"	sta.; 10	hank dou. rov.,	18c.	15½c.	2¾c.	= 36¼c.
40/1 Am. combed warp, 1⅛"	sta.; 9½	hank dou. rov.,	16c.	10½c.		= 26½c.

COST.

1,408 ends 24/2 Am. combed................+ 60% take-up	= .0856	@ 27c.	= $ .0231
2,115 ends 35/1 Am. combed................+ 16% take-up	= .3492	@ 25¾c.	= .0899
128 ends 50/2 Am. combed................+ 6% take-up	= .0065	@ 36¼c.	= .0024
44 picks 40/1 Am. combed................................	= .0629	@ 26½c.	= .0167
Weaving			.0411
Expenses			.0214
			$ .1946
Selling			.0040
Net mill cost (grey)			$ .1986
Bleaching, dyeing, etc.			.0300
Finished cost (not including any profits)			$ .2286

Retail price, $3 per yard.
Yards per pound, 1.98 (grey).

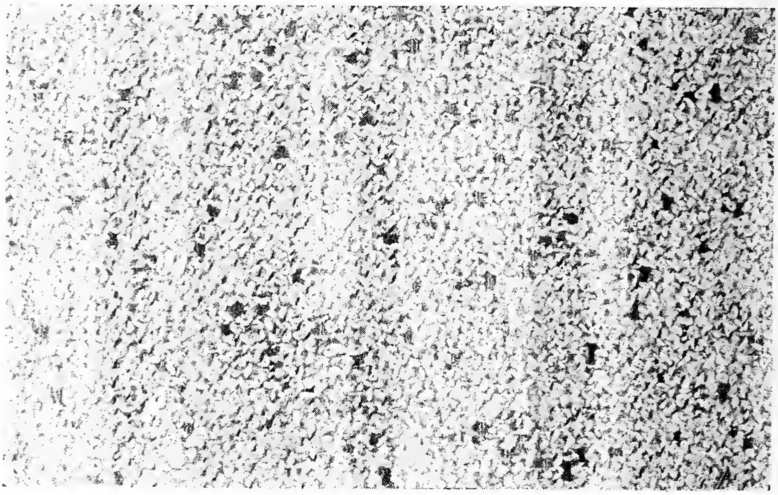
NOVELTY COTTON EPONGE

For the past two years there has been a large and increasing demand for eponge or fabrics of a similar nature not only those which are made from cotton, but also those produced from wool and silk. The spring offerings of high-class cotton fabrics contain more variations of the above named cloth than they do of any other single idea, although in many instances the novelty construction is used in combination with other fabrics to give style to them. Because cotton

yarns are comparatively cheap and variation in size can be obtained easily so as to give good effects, it can be said that the range of ideas being offered in cotton cloths is far wider than it is in any other material. Yarns made from wool are rather expensive and are usually of heavy size and, in many cases, the yarn resulting from the twisting operation is so heavy that cloth woven from it is not entirely satisfactory, although there are a goodly number of wool eponges being sold to-day.

SILK YARNS.

Silk yarns have the fine size which is desirable, but they are smooth and slippery and novelty twists in them do not weave well. Besides, an eponge fabric is necessarily rather heavy, so as to help in the general effect, and the large use of silk in any fabric makes the product rather prohibited in price. It is, therefore, plain that in cotton, or cotton in combination with other materials, the large sale will take place and the best effects be produced. Inasmuch as this fabric is being so widely used it may be well to present an analysis of a cloth which shows decided differences from any which we have formerly treated and which is of quite a little interest at the present time. The cloth we have analyzed is the cheapest, the best and one of the largest selling, if not the largest selling, of any shown in the whole list of new imported styles for next spring and summer wear. When we say the cheapest we do not necessarily mean at a low price, but when the cost of production is compared with the retail selling price, and by the best we mean that the cloth contains certain novel features which place it in the van in its individual field. In other words, the value of an eponge cannot be compared with that of a voile, crepe, silk or other kind of fabric either in style or selling price.



Novelty Cotton Eponge.

Different cloth constructions make such a comparison of little value, although the ratio between cost of manufacture and selling price is often interesting, but even this will vary, depending upon market conditions and demand. It can be stated

as a fact that the cloth analyzed, which sells at $1.50 a yard, is selling at a very much lower comparative price to the cost of manufacture than many others which are selling at $3 and over a yard, and, without doubt, this cloth could be sold in just as large quantity as is now noted at $1 or more a yard than is being asked; that is, it would show better value at $2.50 a yard than many of them which are now selling at this price. It contains certain novel features which place it in a different class from many others, it costs more than others to produce and besides it is in style. These features should warrant a higher price than is now being obtained for it.

EPONGE CONSTRUCTIONS.

In a general way, most fabrics of this class contain a very small number of threads and picks per inch, much fewer than most ordinary fabrics. This is a natural condition, because the novelty yarns which are used are rather coarse in size, and the low count of the cloth aids in giving the effects desired. It is often possible to use a much lower count in such fabrics than it is in other classes of materials, simply because the irregularity of the yarn decreases the possibilities of slipping and makes quite a firm construction. A novelty yarn fabric with a certain size of yarn would be a much firmer fabric than a voile containing the same size of yarn for very evident reasons. Eponges are made of grey yarns, which are woven, and then the cloth is bleached or dyed. They are made from bleached and dyed yarns, and it is from these materials that possibly the widest variety and the best cloth effects appear. In some instances. the cloths are made from yarns which contain stock-dyed cotton, but this is not nearly as common a process as that wherein the yarns are bleached or dyed.

YARNS OF GREAT VARIETY.

The yarns which compose the fabrics are of great variety, for they are made from the different materials in combination, from different colors of the same or different sizes of yarn, and besides, the yarns are made in radically different methods, such as are noted in corkscrew, nub, loop and slub in endless variety. To develop a yarn which looks well in the cloth and still creates no great amount of trouble in weaving is by far the most important problem in the production of eponge cloths. It often happens that a yarn can be made which looks well before it is handled or woven but which will not give a satisfactory cloth. As a good many of such novelty yarns are made by two twisting operations, the last being for the purpose of binding, it is necessary to have the right amount of twist, or the effect produced is not the best which it is possible to obtain with the yarns used.

Sometimes special machinery is necessary in the production of yarns of this character, and at other times they can be successfully made on an ordinary spinning frame, although sometimes this is impossible, simply because spinning frames are not available, inasmuch as they are producing single yarns and cannot be spared even if the novelty yarns are responsible for a higher profit.

Of course, the most interesting feature regarding the fabric analyzed is that which relates to the yarns which are used, and the method by which they are made, but, in addition to this feature, is the one that the cloth contains a pattern which is made by the use of yarns in which different colors have been used for the nubs. The warp contains novelty yarn in patterns, as will be noted from the warping plan given in the analysis, and is made from yellow and black yarn for nubs, while the filling contains novelty yarn on which all the nubs are blue. This in itself makes a novelty fabric and much different from the majority of such cloths.

In the consideration of the novelty yarn we will assume that the single yarns are all normal, or that they are in no case different from those noted in ordinary cloths. Through the spinning operation this causes no changes from those noted in an ordinary mill. In the first twisting operation two ends of 50s-1 are used as a ground thread, while the

11½s-1, which is delivered by a separate set of rolls and is about 100 per cent faster than the 50s-1, twists around the outside of the two ground threads. Twisters making novelty yarns always contain two or more sets of delivery rolls, so as to feed the yarns at the correct speeds.

It will easily be seen that the yarn produced from the above process cannot be used in weaving, for the heavy yarn which twists around the ground threads will slip and be generally unsatisfactory, and, besides, it will not contain the loop effect so desirable at present. To make this loop effect more prominent, this loose corkscrew yarn is usually taken and twisted again with another fine yarn but in the opposite direction to that of the first twisting process, and while this second twisting operation binds the yarn firmly so that it can be woven it also makes the loops quite prominent for the untwisting operation and loosens up the heavy yarn which makes the corkscrew. This is the process which is employed on many of the yarns used in the ordinary cotton eponges. In the yarn which is used in

THE CLOTH ANALYZED

the second twisting process shows a decided difference from that noted in most cotton eponge yarns and such as that described above. Instead of the binding thread in the second twisting operation being for binding purposes alone it is also used to form the colored nub. This binding yarn is of colored two-ply spun silk.

One advantage noted is that the roughness of the yarn produced in the first twisting operation partially covers up the silk yarn between the nubs, although the silk binds the loops and permits satisfactory weaving. Yarn nubs, such as are noted in the fabric considered, are made in two methods, which might be called identical. In one method both yarns are fed by rolls regularly but at different speeds, and a slide or guide follows the ground yarn down a certain distance, placing the extra yarn, which, of course, forms the bunch, in one spot. Often when such a machine as the one described is used, more than one color of yarn is utilized, which is delivered extra, and this results in a number of nubs of different colors.

The other method of production is to have the nub yarn delivered regularly, while the ground yarn is delivered irregularly; that is, the latter will move forward a short distance and then stop, while a nub is formed by the extra yarn which runs steadily and then the ground yarn will move forward again, and the process is repeated. In the yarn used, the silk which forms the nubs has been delivered about 50 per cent faster than the corkscrew yarn which forms the base or ground yarn in the second twisting operation. Mercerized yarns are used extensively in the production of cotton yarns for use in eponge, and, of late, colored silk is being used to a certain extent. In a general way, carded yarns are more widely used than combed yarns, because their irregularity in many cases adds to the attractiveness of the fabric when woven.

YARN COST.

There are a good many items which are likely to affect the cost of making novelty yarns of any kind. In the first place, the production is usually limited in volume, and this naturally affects the price. In addition to the small quantity made there is the cost of experimentation, which will vary widely for different yarns and which is not necessary on ordinary ones. It is also true that operatives run fewer spindles than they do on ordinary work, and for this reason, the actual labor cost a pound is high. While the operatives run fewer spindles than is usually the case, the production per spindle is likely to be quite large, for the yarns are rather heavy in size with comparatively few turns per inch twist, and this fact makes the cost per pound lower than if a spindle did not produce so much yarn.

Even though the twisting cost per pound and the price of the yarns used be accurately known, it is quite a problem to obtain the cost of the novelty yarn, because not only is there the combination of three or more yarns at different prices, but each yarn has a varying take-up which affects the results radically. Inasmuch

as the finished yarn sizes 3.87, or contains 3,251 yards per pound, this yardage will form the basis fcr the total yarn cost. The

YARN TAKE-UPS

in the finished novelty yarn are as follows: 50s-1 equals 4 per cent, 11½s-1 equals 48 per cent and 30s-2 silk equals 32 per cent. These take-ups can be added to the yarn sizes, thus making them relatively heavier so as to obtain their correct weight, or they can be added to the 3,251 yards per pound, thus giving the actual yards of each yarn used in producing one pound, or 2,251 yards of the novelty yarn. We have used the first method, which gives relative yarn sizes of 48, 5.98 and 20.4, as will be seen from the cloth analysis. Either method will give the weight of each yarn which forms the novelty, and with the single yarn prices, the total material cost is easily obtained. The twisting charges should be added to the cost of the material as found so as to give a total novelty yarn cost.

The weaving of most kinds of cotton eponge fabrics is a rather simple proceeding. Inasmuch as the yarn contains practically all of the novelty features, it is usually the custom to weave the cloth on a plain loom and with a plain weave, for a fancy weave would not be likely to show at all. In the fabric analyzed a warp pattern has been introduced so as to add variety to the effect, but the weave employed is plain. One item of interest which has a good deal to do with the cloth price is the cloth construction, or small number of picks used in weaving the clcth. This results in a large production in yards and consequent lowering of weaving cost, because it is divided by a greater number of yards. Loom speeds are slower

PATTERN.

Yellow nub novelty.........	8		10		3		3		12		3		3		10		8	=	384
Black nub novelty.........				4		10		4		4		10		4				=	360
				19 ×															744 ends.

Blue nub novelty filling. 17 picks.
15 reed, 49" width in reed, 45½" width finished.
16 × 17 finished count.

YARNS.

	Cotton.	Labor, waste, bleaching, etc.		
50/1 Am. combed. 1¼" sta.; 10 hank dou. rov.,	20c.	22¼c.	=	42¼c.
11½/1 Am. carded. 1¹⁄₁₆" sta.; 2¼ hank dou. rov.,	14c.	7½c.	=	21½c.
30/2 spun silk, dyed and on spools				$3.50

NOVELTY YARN COST.

Finished yarn size = 3.87, or 3,251 yards per pound.

Yarn sizes with take-up = $\begin{cases} 50/1 = 48/1 \\ 30/2 = 20.4 \\ 11½/1 = 5.98 \end{cases}$

$\dfrac{3.251 \text{ yards} \times 42¼\text{c.}}{48 \times 840}$ = .0341 (2 ends used) .... = $ .0682

$\dfrac{3.251 \text{ yards} \times 21½\text{c.}}{5.98 \times 840}$ .... = .1391

$\dfrac{3.251 \text{ yards} \times \$3.50}{20.4 \times 840}$ .... = .6640

Material .... $ .8713

Material, $.8713 + $.08 twisting = 95c. per pound. total cost.

CLOTH COST.

744 ends 3.87 novelty + 9% take-up = .2514 @ 95c.	=	$ .2388
17 picks 3.87 novelty = .2562 @ 95c.	=	.2434
Weaving		.0242
Expenses		.0064
Net mill cost		$ .5128
Selling expenses		.0350
		$ .5478

Yards per pound. 1.97.
Retail price, $1.50 per yard (imported).
There are no profits at all considered on this cloth for either makers or sellers.

on fabrics of this character not only because of the yarn used but also because the cloth is made in a rather wide width.

Imported cloths are usually made in this manner, and actually result in a lower producing cost than would otherwise be obtained. Domestic manufacturers, or rather converters, have been inclined to cut off the width of the cloth when the price became prohibitive, and in this manner, getting it within their price range, but this is a mistaken policy, so far as value is concerned, because the costs of making are practically no lower for a 27-inch cloth than they are for a 36 or 38 inch one. A comparatively small profit per yard will return good dividends; that is, on many of the fabrics being sold at about 10 cents a yard, a net profit to the mill has to be obtained of anywhere from a half to a cent a yard, if dividends be satisfactory, or, say, about 10 per cent of the total cost of making, while the same ratio or profit on this kind of material would be likely to return dividends of over 100 per cent on the investment, due to the large yardage which each loom can produce. This cloth is practically ready for use when it comes from the loom, a fact which results from the use of bleached and dyed yarns. Care should be used in adjusting the loom so that the yarn breakages will be as few as possible, for every time a thread breaks the novelty twist effect disappears.

Often in using novelty yarns, the ground yarn will break, allowing the effect to disappear, but the thread will still weave and produce a bad place in the fabric. This shows the importance of using yarns of sufficient strength in comprising the novelty twist thread, for the strain comes entirely on one or two threads, thus making the novelty yarn no stronger than some rather fine two-ply yarns.

YARN AND CLOTH WEIGHTS.

The method of obtaining the yarn and cloth weights is exactly the same as for any ordinary fabrics. It is a good plan, if the cloth is to be duplicated exactly, to size the finished yarn and then to analyze it, finding the component parts and their take-ups, in other words, to check up the actual yarn size with the figured size, just the same as the actual yards of cloth per pound are checked up by the figured weights of the yarns which compose it. The figured yarn size is obtained as follows, and it corresponds exactly with the actual size obtained from weighings:

50/1 size × .96 = 48/1, the relative size.
2 ends of 48 used = 24/1, ground yarn, relative size.
30/2 silk × .68 = 20.4/1, relative size in silk.
11½/1 × .52 = 5.98/1, relative size for heavy yarn.

Then applying the rule for obtaining the average size of yarn when three yarns of different sizes are used, we have

$$24 \div 24 = 1$$
$$24 \div 20.4 = 1.176$$
$$24 \div 5.98 = 4.013$$
$$\overline{6.189}$$
24 ÷ 6.189 = 3.87, completed yarn size.

When the size of the novelty yarn has been obtained, the weight of the warp and filling and the yards per pound can be obtained in the following manner:

744 ends ÷ (3.87/1 × 840) = .2288, weight of warp without take-up.
9% take-up in weaving.
.2288 ÷ .91 = .2514, total weight of warp yarn per yard of cloth.

$$\frac{17 \text{ picks} \times 49'' \text{ reed width} \times 36''}{36''} = 833 \text{ yards}$$
of filling per yard of cloth.
833 ÷ (3.87/1 × 840) = .2562, total weight of filling yarn per yard of cloth.
.2514 + .2562 = .5076, total weight per yard.
1.0000 ÷ .5076 = 1.97 yards per pound (finished).

JACQUARD EPONGE

One general class of fabrics which has previously never been considered of any great importance in cloth sales is that class which is composed of yarns of novelty construction, or at least contain a certain proportion of such yarn. That this is a very broad classification will be readily recognized by anyone familiar with the details of cloth making, but inasmuch as there are no definite constructions used, and almost every fabric has certain individual features, it may be well to present only general ideas re-

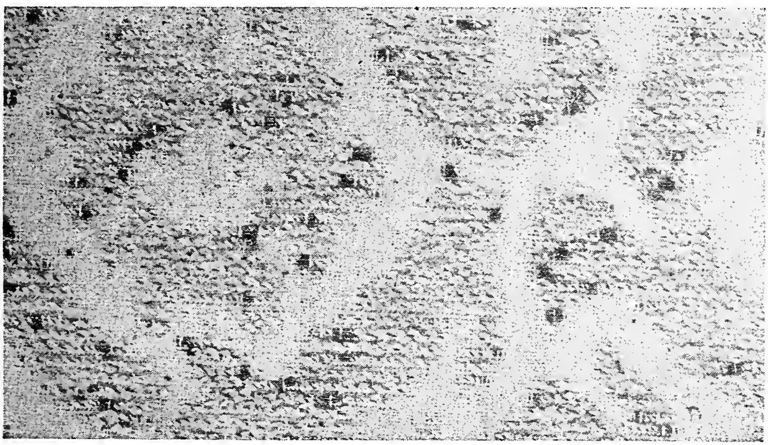
garding the cloths and their methods of making. Within the past year, large quantities of such materials have been produced, and it is needless to state that the quality is better and the variety of patterns produced enormously wider than they ever have been in the past.

The increased demand has been a gradual process, and in this way has been more interesting than some of the other recent styles that have sold well. Sellers expected that the idea would be short-lived when first offered, but the production of it in wool and in silk, and also the necessity for

A RADICAL CHANGE

in style, all had an influence in the situation, so that to-day the novelty yarn idea stands preeminently first when the sales of high-class novelty cotton fabrics are considered. The materials are, of course, finding their largest distribution as a dress fabric, but there are many other opportunities for advantageous use, such as the trimming of other sorts of materials, for ties, hats, coats, vests, numerous forms of coverings, pillows, draperies, in fact, the influence of the idea is found on all grades and prices of material, from decorations in the lightest fabrics to composing entirely some of the medium and high-grade cloths and selling at prices which show a wonderful variation, even for somewhat similar materials.

One feature which has been very evident in sales and prices is that very few sellers have had any accurate idea regarding values or cost of making, for they had absolutely no previous details on which to base their estimates, and, naturally, by the time these cloths have reached the consumer, exorbitant and unreasonable prices are many times noted. That is, a fabric costing perhaps 25 cents per yard to make may be offered to retail at $1.50 a yard, while another costing more than twice as much may be sold at the same price, and all because someone in the line of sellers could not realize the value of the different fabrics.



Jacquard Eponge.

MATERIALS USED.

In a general way it can be said that the combinations used in making such yarns are numberless. They can be made out of cotton, wool, silk, or even other materials, but the first three named form by far the largest portion, or practically all, of the products, with the fabric composed of cot-

ton easily leading. Then there are the various results which can be produced by a combination of two of the above-mentioned materials, and which combinations are of value in lowering the cost, or in giving effects not otherwise possible. Thus, it will be seen that there is a very good foundation for the production of varying results at the mill.

In addition to the variation possible through the use of different materials, there is the vastly greater opportunity which is afforded by mill processes. Different sizes of yarns will produce radically different effects, and even the amount of twist inserted in the yarn has a decided influence on the result obtained. Most of the yarns used are the result of one or more twisting processes, but there are also other methods by which quantities of cloth are made. One process uses waste cotton or silk fibres and makes an irregular yarn and cloth. Another has a device which feeds in bunches of cotton stock to a twisting yarn, which twists in the cotton and holds it tightly, the bunches of cotton being of any desired color. Then there are the various kinds of twisted yarns, those which contain loops, those which contain nubs and those in which there is a regular corkscrew effect. Not only are all the above made in the grey state, but they are also made with different colors and combinations of color, sometimes in a number of different methods on the same yarn. Mercerized yarns are also used extensively, and, recently, fast colors have been used, and these methods offer great opportunities in the production of certain effects at radical reductions in price.

CLOTH CONSTRUCTIONS.

Inasmuch as these novelty yarns are a combination of a number of other yarns, they are usually rather heavy in size, and because the yarns are coarse the cloth count is comparatively low. It is also a fact that the count is low because the yarn irregularities give an additional firmness not noted when ordinary yarns are used, and through the lower count the desired effects show up to much better advantage. Because the ultimate yarn size is heavy, a good many have been inclined to treat the making and the yarn combinations in too trivial a manner, that is, they do not consider that practically all the strain comes on one or two ground threads when the cloth is being woven, and that unless due care is exercised these threads may break in the weaving process, thus allowing the loops, nubs, or yarn effects to disappear, although the thread as a whole does not break apart. This causes bad places in the cloth, which, in high-priced materials, create a second.

In most cases, a fabric composed entirely of novelty yarn is made with plain, or at least one of the most simple of ordinary weaves. This is done because the yarn constitutes largely the cloth effects, rather than the weave employed. Recently, in novelty yarn decorated fabrics, there has been quite a number of offerings of fancy woven figures, in addition to the effects made by the yarn, and which show a great deal of adaptability on the part of the makers. The weaving of the cloth is, therefore, a comparatively simple process, although the weaver operates a smaller number of looms, and the filling has to be changed more often, because the amount of yarn on a bobbin is so small. The yardage produced per loom, however, is quite large, even if the percentage of production be lower than for most cloths, because the picks per inch are few, and this makes a large yardage production and naturally aids in lowering the costs of making.

YARN CONSTRUCTION.

We have already given a general idea regarding the yarns used and their wide variety, but it may be well to describe in a little more detail the method of making one of the general classes noted. This is the so-called loop yarn, which is now used so extensively, although it is not made generally by the method employed some time ago. In the first place, the yarns used in making this loop yarn are in most cases identical in construction to the warp yarn of

the sizes used, so that up to the twisting operation general yarn details apply.

A good many have not attempted to make novelty yarns, because they have no special twisters, but such equipment is not always necessary in a good many cases, for the same or similar results can often be obtained on an ordinary spinning frame, if such machine be available. In the first twisting operation two kinds of yarn are used, one which is coarser than the other, and which is delivered by one set of rolls at about twice the speed of the rolls delivering the finer yarn.

It will readily be noted that this coarse yarn, which is delivered faster, will coil around the finer ground threads, but unless a lot of twist be inserted the two yarns will slip badly and be impracticable of weaving or handling. It will also be noted that no loops are formed, but only a combination of two yarns, which slip on one another when rubbed. In order to make the loops or irregularities and render the yarn weavable, this loose-twisted product is taken and again twisted with one or more ends, but in the opposite direction to that of the first twisting operation. This

RETWISTING PROCESS

loosens up the extra yarn delivered in the first process and makes irregular loops appear, and the binding down by the ends delivered in this second process holds the whole result, so as to make it a practical yarn. The obtaining of the yarn size, when combinations are made in this manner, is sometimes rather difficult, but the following illustration will serve to show how the yarn size is obtained on one of the twisted yarns which has been described:

2 ends 60/1 ground threads	= 30/1 comparative size.	
2 ends 30/1 loose yarn	= 15/1 comparative size.	
2 ends 60/1 retwist	= 30/1 comparative size.	
30/1 ground	= 30/1	
30/1 ÷ 30/1		= 1.000
15/1 + 50% take-up	= 7.5/1	
30/1 ÷ 7.5/1		= 4.000
30/1 + 12% take-up	= 26.4/1	
30/1 ÷ 26.4/1		= 1.136
		6.136

30/1 ÷ 6.136 = 4.89/1, resulting yarn size.

Of course, the yarn size is often obtained by sizing the finished result just the same as is ordinarily noted for cotton yarn, but while this is satisfactory in obtaining the weight of the woven fabric, it does not permit the manufacturer to estimate the amount of the various yarns which he must spin so as to complete an order, neither does it give him even a general idea regarding the average cost of the yarn produced. As a general statement, the cost of making novelty yarns is not so high as many believe, especially on those kinds which have a regular production, because the twist per inch is comparatively low and a large poundage per spindle is produced.

Naturally, two twisting processes for the same yarn are more expensive than where only one is used, but the price is not prohibitive, and allows a large profit when to-day's cloth selling prices are considered. The largest cost in addition to the yarn cost is often noted, because of the experimentation required to produce satisfactory results, and this should be considered in the cost, because it is usually a special feature. The

COST OF THE YARN

material previously considered is obtained as follows:

Finished yarn size 4.89/1, or 4,108 yards per pound.

Yarn sizes including take-up.	60/1 two ends = 30/1 30/1 two ends = 7.5/1 60/1 two ends = 26.4/1

With grey yarn of the above sizes, costing to produce at the mill $44\frac{1}{4}$ cents for 60-1 and 26 cents for 30-1, the average price of the yarn material would be obtained as follows:

$$\frac{4{,}108 \times 44\tfrac{1}{4}\text{c.}}{30/1 \times 840} = \$\ .0721$$

$$\frac{4{,}108 \times 26\text{c.}}{7.5/1 \times 840} = \$\ .1695$$

$$\frac{4{,}108 \times 44\tfrac{1}{4}\text{c.}}{26.4/1 \times 840} = \$\ .0819$$

$ .3235, total cost of yarns used per pound.

The above amount is for the yarns alone which compose the novelty effect, and there must be added the

amounts of labor, expenses, insurance, etc., noted in twisting operations, and also, as previously stated, a certain amount as the cost of experimentation, and which will vary widely, in some cases being practically nothing per pound, and in other cases very large. It is believed that a large proportion of mills which are making novelty yarns have been somewhat lax in obtaining their correct costs, and that if they had been more accurate in the matter a greater amount of cloth would have been made, for some of the profits received would have been more readily ascertainable. Only by treating each yarn cost separately can the correct result be obtained, and when the yarn costs are not correct, the cloth costs naturally cannot be.

WEAVING FACTS.

It has been previously explained just why most of these cloths are made with plain weaves, but there are certain other features which are of interest. Because of the nature of the cloth, the loom speed is likely to be somewhat less than it is on ordinary fancy cloths, but the production per loom is large, because there are so few picks per inch. The looms per weaver are comparatively few, in many fancy fabrics there being but one loom to a weaver. Conditions of weaving differ widely, because of the widely varying styles of fabrics, and results which can be obtained on one construction in a certain way are not always possible on another fabric. The more complicated effects are produced by the use of dyed and bleached yarns.

At present retailers are selling a wide variety of these fabrics in the plainer constructions, but in order to continue the idea cloth makers are producing crepes, voiles and other fabrics, which contain decorations of novelty yarns, they are adding checks and fancy effects to other cloths, for which there is a wide sale, and they are using stripes which contain different colors, so as to give a wider range of production. The idea is also being applied to stripes in curtain fabrics, and in many other ways not generally recognized. In fact, there never has been a time in the past when any one idea was applied to so many different cloths and in such widely varying effects as at present. One feature not to be lost sight of when novelty cloth is being sold extensively is its effect on the future of cloths and the cloth-making industry.

Without doubt the large production of novelty yarn fabrics will develop a more or less steady use of such materials, thus creating a broader industry and

A GREATER CHOICE

of fabrics among consumers. It is being admitted to-day that voile fabrics have proved such desirable materials that there will be a continual demand, although the present large use will not be noted, and the same results are likely to be seen regarding certain of the novelty yarn goods. Their making also has a great amount of influence at the mills, for it develops ability through experience, and makes a better class of operatives or overseers, and ones who are able to handle somewhat difficult situations.

There are many mills to-day producing novelty yarn cloths which previously considered them entirely out of their field. Even many of the ordinary print cloth mills have made and sold fabrics which contain stripes or variations from the ordinary run of cloths, and which often result in a better profit to the makers, and such methods tend to develop a broader industry, and one able to take advantage of all the opportunities which are presented by the changes in cloth styles.

FABRICS AND WEIGHT.

To show the wide variety of cloths produced we present a few of the many now selling. One is made entirely from white yarn, but it has a novelty effect produced by loops and also by bunches of cotton inserted in the yarn. The weave used is plain. Another fabric has a novelty yarn warp, with a plain yarn filling, and, because of the fine and coarse nature of the warp; an effect is produced not much different from that of the ordi-

nary ondule cloth. The weave on this fabric is also plain. Another fabric is made with a combination novelty yarn, which has a loop effect for ground and a binder in the retwisting operation, which works as a nub and produces a contrasting effect in colors.

Stripes of different colored nubs are used, and the effect is very attractive when this kind of cloth is being considered. Plain weave also forms the basis for this fabric. One fabric which has recently appeared, and which shows quite radical changes from the ordinary fabric, has a mercerized yarn ground very similar to an ordinary poplin but with a five-harness weave used instead of plain. and, in addition, has a jacquard figure introduced by a portion of the filling, which has a combination novelty yarn effect with loops and nubs.

PRICES VARY MUCH.

The prices of these cloths vary quite a little and range from $1.50 to $3 per yard for cloths which are most of them over 40 inches in width. One item of interest is that novelty yarn fabrics have been partly responsible for the largely increased price of cotton goods, which is partially justified by the cost of production and the prices which are noted when any idea is in demand. Without doubt the era of fancy cloth making in domestic mills has just commenced, and if the future shows as much increase in adaptability and in styling as has been noted during the past year, there will be very little opportunity for criticism regarding the progress of the domestic industry. The weight of the yarns and the weight of the resulting fabric which contains novelty yarns is obtained in a similar manner to that employed on ordinary fabrics that is, after the yarn size has been obtained. The weight on one of the fabrics, which is illustrated, is as follows:

Yarn size 3.87/1 (relative size).
Threads per inch 16.
Picks per inch 17.
Width of cloth finished 45½".
744 ends ÷ (3.87/1 × 840) = .2288, weight of warp without take-up.
9% take-up in weaving.
.2288 + .91 = .2514, total weight of warp per yard of cloth.

$$\frac{17 \text{ picks} \times 49'' \text{ reed width} \times 36''}{36''} = 833 \text{ yards}$$

of filling per yard of cloth.
833 ÷ (3.87/1 × 840) = .2562, total weight of filling per yard of cloth.
.2514 + .2562 = .5076, total weight per yard.
1.0000 ÷ .5076 = 1.97 yards per pound.

STRIPED BEDFORD CORD

Bedford cords have been in small demand for a number of years past, partly because styles did not use them largely, and partly because cotton was high in price. These fabrics, though many times made of fine yarn and having a high count, are usually quite heavy, and use quite a little material. As is well known, the demand has lately increased and many varieties and constructions are being offered and sold. Most of these fabrics are sold in the white state, but many new patterns are seen in colors. Because of manufacturing conditions, wherein expenses were high from the use of comparatively fine bleached yarn, most of the cloths were made in the grey state and bleached when woven. With the making of fast colored yarn to stand bleaching, it is expected that more colors will be used in stripes in grey woven cloth, not only in fabrics similar to sample, but also in various other lines in which colors can be used to an extent for varying the patterns.

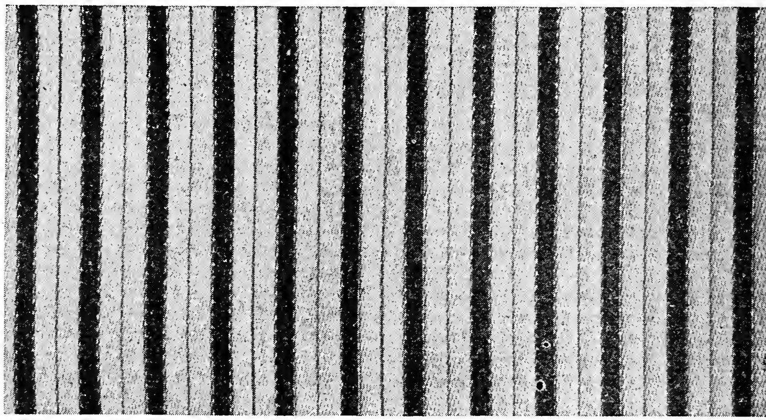
The fabric considered is an imported one, and there are a number of interesting features regarding the cloth. It is made in the usual method in constructing such patterns, that is, the weave appearing on the face of the cloth is plain, and the filling weaves alternately in every second cord, two picks being woven into the face and then reversing to the back on the following cord, where they hold in threads used for the purpose of rounding out the cords on the face. These threads held in to make the cords round are called stuffer ends. The cord which is composed of black yarn is one dent smaller than those made of white yarn. In our drawing-in draft we have placed the selvages on separate harnesses, although they

weave similar to the stuffer, and in making up the warps, they would probably be placed on these stuffer harnesses. We have separated them from the main warp to make the draft somewhat clearer. It is to be noted that an end of plain weave must be used on the outside of each selvage to keep the filling from slipping back, as the selvages have two picks in a shed.

DETERMINED BY STYLE.

One of the interesting facts in connection with this cloth is that the warp is all two-ply yarn, while the filling is single, and another is the low number of picks in the cloth, namely 64. From large experience in making and selling this variety of cloths, it is not believed that a fabric constructed in this way could be sold by an American manufacturer. The fabric has so few picks and the filling yarn is so fine in comparison with the warp that there is little strength filling-ways of the cloth, and a buyer would not accept any such fabric. A slight strain will result in destroying the cloth. The reason why such a construction was purchased was because a retail buyer bought the goods and few of them are influenced by any cloth quality a fabric has, but the style determined the purchase. Large retailers import fabrics, and this is one of the fabrics purchased.

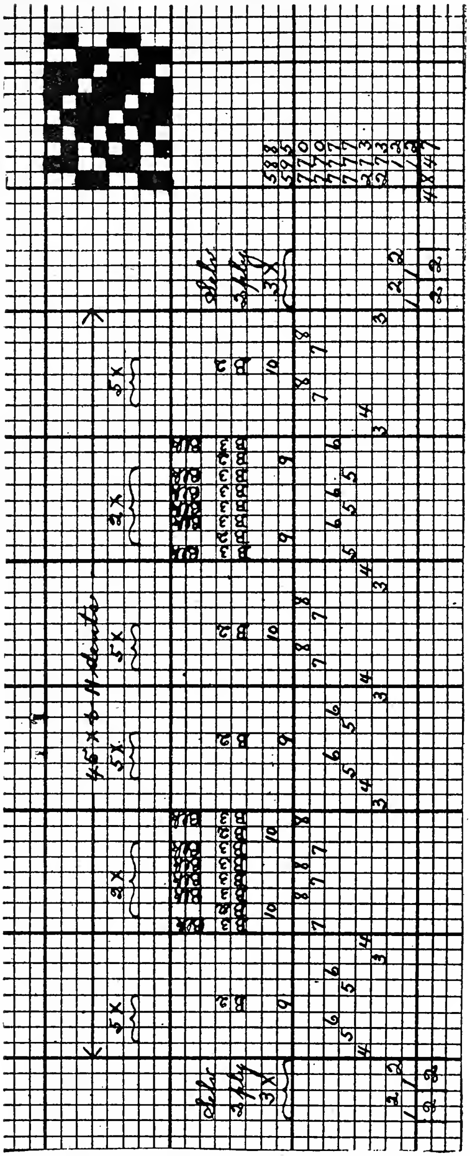
The other interesting features in this connection are the facts regarding prices. This fabric is to-day retailing for 75 cents per yard, and it is not believed its selling price finished in Europe was over 25 cents per yard, which, with the added price for duty, would allow a large profit to anyone handling such a cloth. As a manufacturer's profit on a cloth of this kind would not be over two cents per yard, and in the majority of cases, not much over half this amount, it can be seen how cheaply these cloths can be made. It can be stated as a fact that domestic mills would not be guilty of making many cloths with constructions like sample, and what is more to the point, they could not get away with any such fabrics if they did offer them. There are many cloths sold in America to-day, similar to sample, which are far better value than the one analyzed.



Striped Bedford Cord.

Few Bedford cords are being sold by domestic mills or converters to-day at over 25 cents per yard, unless they can show a much better construction or more value than the one considered.

This instance is one which only illustrates the hold which retailers



Draft.—Body of Fabric Reeded as Follows: 4, 6, 5, 4, 5, 5, 5, 4, 6, 5, 4.

have on distribution and the prices which are charged. Many

AMERICANS ARE FOOLED

by the imported label. This is used by many to get higher prices for their wares, notably different classes of textiles. Because so many Americans were at some time or other natives of Europe, they have the feeling that

any imported fabric is better than those made in America. While this may be true in some instances, there is an increasing knowledge that this condition is not warranted by facts, and many are beginning to see that a large part of this feeling is mere hearsay, for a large percentage of mill employes are of foreign birth and education, and very few real Americans are found in the factories to-day. It is becoming known that many of the beautiful fabrics produced in America are sold as of foreign product, so that while the manufacturer does not reap any rewards of this practice, either converter, jobber or retailer does.

The process keeps educating consumers into the belief that Americans are far behind in manufacturing good cloths, and does stimulate importations of fabrics which might be made by domestic manufacturers otherwise. This is possibly one reason why some jobbers and many retailers object to selling trade-marked textiles. If all textiles were trade-marked in some manner so that consumers would know they were of domestic make, there would be a surprising condition of affairs revealed, and many of the large profits secured by some sellers would be reduced, or possibly the manufacturers would obtain somewhat larger profits.

Bedford cords require but

FEW HARNESSES

to weave, usually not over eight, and although most mills with dobby looms make them, the price is high, because they are a heavy cloth. The count is high in most cases, being many times over 120 times 120. For this reason the yards produced are small in comparison to many other lines of fabrics. Because of the high number of picks the warps must be well sized or the friction will break the ends. It is necessary to use a rather coarse reed to obtain satisfactory results in weaving. Quite a few ends must be reeded together, and sometimes the best running result can only be determined by experimentation. The take-up in weaving of the stuffer ends is very small, as they lie nearly straight in the cloth. If dyed yarn be used for the stripe in weaving and grey yarn for the remainder of the warp, the take-up on the color is likely to be more than on the rest of the warp, unless care is used in weaving. If the take-ups are not nearly the same, a different appearance is sometimes seen on the various stripes in the cloth.

This fabric, although it has a

HIGH WARP COUNT,

has the same appearance which all these lines do when few picks are used in weaving. The nice smooth surface is missing, as in reality only 32 picks per inch are used for the face of the cloth. We have never seen a satisfactory Bedford cord made with a very small number of picks, and domestic makers seldom make cloths with less than 80 picks per inch, and whenever fewer picks are used, it is to get a cloth made which will sell at a certain price. About ten years ago, quite a few Bedford cords were sold with fancy weaves, and various constructions in combinations, and it is likely many of the ideas then used will be reproduced with the addition of color which was not available at that time.

There is no question but that the advent of fast colors to stand bleaching has opened large fields which have never before been utilized, as can be noted in the making of stripes and checks in silk and cotton novelties, in the making of stripes in Bedford cords, in the making of stripes in mercerized piece goods, and it can be utilized in the manufacture of novelty yarns in making the cloth called eponge or Turkish toweling, which buyers are at present interested in largely.

While Bedford cords and piqués are used for a variety of purposes, it is believed by some that unless business increases largely there will be a surplus of these cloths the latter part of the coming season. As a rule, the total amount sold of novelties of this character is small, and sellers have many lines in hand, and quite a few of the orders at the mills are for these cloths, so some doubt is expressed re-

garding prices later in the season. The interest expressed in other newer fabrics is likely to detract somewhat from the sale which was anticipated earlier in the season on various styles of Bedford cords.

PATTERN.

	2														2	
50/2 Am. combed white.	12	3		2	2						4		2	1	12	= 2,778 beam No. 1.
37½/2 Am. carded white			1				1		1			1				= 1,183 beam No. 2.
50/2 Am. combed black.						1		4		1						= 910 beam No. 3.
			5 ×				2 ×					5 ×				4,871 total ends.
							91 ×									

50/1 American combed filling; 64 picks.
30 reed, 33¾" width in reed, 32" grey width, 31⅝" finished width; 152 × 64 grey count over all; 154 × 63 finished count over all.

YARNS.

	Cotton.	Labor, waste, etc.	Twisting.		
50/2 Am. combed, 1¼" sta.; 10 hank dou. rov.,	21c.	14¼c.	3c.	=	38¼c.
37½/2 Am. carded, 1⅛" sta.; 7½ hank dou. rov.,	17½c.	7¾c.	2c.	=	27¼c.
50/1 Am. combed, 1⅛" sta.; 12 hank dou. rov.,	17½c.	12½c.		=	30c.
50/2 black, same as above, with addition of 16c. for dyeing, beaming, etc.				=	54¼c.

COST.

2,778 ends, 50/2 Am. combed................+ 8% take-up = .1438 @ 38¼c.	=	$ .0550
1,183 ends, 37½/2 Am. carded...............+ 2% take-up = .0767 @ 27¼c.	=	.0209
910 ends, 50/2 Am. combed black..........+ 8% take-up = .0470 @ 54¼c.	=	.0255
64 picks, 50/1 Am. combed..............................= .0514 @ 30c.	=	.0154
Weaving		.0147
Expenses		.0133
		$ .1448
Selling		.0029
		$ .1477
Bleaching, etc.		.0150
		$ .1627

Yards per pound, 3.14.
Retail price, 75c. per yard.

SWISS APPLIQUE (PRINTED)

We have at various times described different classes of fabrics which are decorated in some manner other than by the weave, that is, either through the use of a swivel or lappet motion, or through the use of the box loom or the embroidery machine. There is another class of fabrics which is not sold very extensively, but which shows a much different appearance and is produced in a radically different manner than any of those which we have previously described. In a general way, it is a fabric in which there are decided contrasts, that is, with portions of the cloth rather thin and transparent, and with other portions opaque even when they are of the same color as the ground cloth. Probably in the majority of instances these cloths have a white ground and are decorated with colored figures in what might be called

GEOMETRICAL PATTERNS.

An ordinary examination of the finished material will show that the small spots are stuck onto the cloth in some manner. These will stand the ordinary washing process in a satisfactory manner, and whenever such fabrics are desirable this method of production can be used. Some of such fabrics are continually sold, but at certain times when very light ground fabrics of a rather crisp nature are desirable a much larger quantity can be sold. The fabrics are used for dresses, waists, collars, cuffs, trimmings and various other small made-up articles for women's wear. The fabrics are not especially durable because they are so light, but they are

practically as durable as any other fabric of a similar construction.

DIFFER FROM ORDINARY PRINTS.

The results are produced by a process much similar to printing and which will be subsequently described, but it may be well to enumerate certain of the differences which exist between a fabric such as analyzed and an ordinary printed fabric wherein the same or similar ground cloth is used. The first thing which will be observed is that the figure is raised above the surface of the cloth whereas this does not occur in an ordinary printed material. For another thing it will be noted that the printed pattern appears on both sides of the cloth and in a similar manner, that is, the figure is raised on both surfaces. On an ordinary printed cloth the pattern seldom is as prominent on the back as it is on the face, and in a good many instances it is hardly visible at all on the back of the cloth.

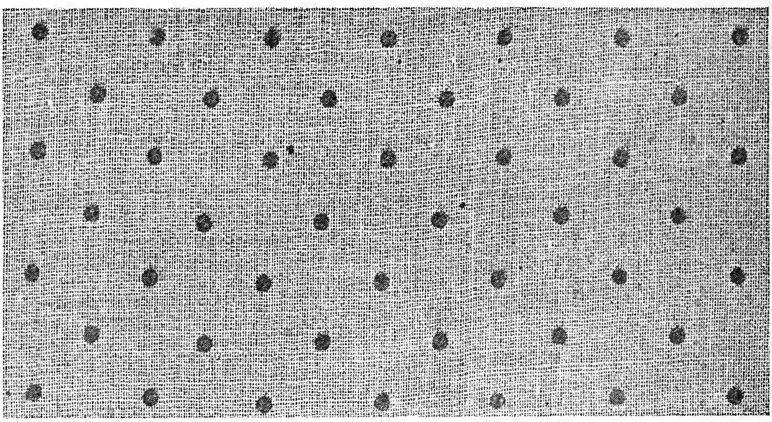
One of the most prominent features in such fabrics is that there is a wide divergence of the patterns from those ordinarily noted, at least in a large majority of instances. Continuous or

SCROLL PATTERNS

cannot be produced and geometrical figures are more often noted, these figures being made up of small spots or dots of various sizes. The ordinary printed pattern often contains scroll patterns, and except in the cheaper grades does not often consist of spots, at least not arranged as they are in the fabrics under discussion. The feature that would be noted by a consumer before anything else would probably be the fact that the ordinary printed pattern contains a number of colors arranged in harmony to produce the flower or effect desired, whereas in these printed Swisses there is seldom more than a single color used. Wherever the printed pattern appears on an ordinary fabric it is very easy to move the threads and picks back and forth if the fabric construction is not very firm, and, in addition, the threads and picks composing the cloth are always visible, whereas in the fabric analyzed the figure entirely covers up the yarn and does not permit any movement of the threads whatever. Any large pattern on this sort of printing will

MAKE A FABRIC STIFF

and somewhat undesirable, and for this reason quite a little judgment has to be used in the amount of figure which is applied. It may be well to note here that it is desirable to have the ground cloth of good quality just



Swiss Appliqué (Printed).

the same as when printed patterns are being applied under ordinary circumstances. Any great amount of irregularity in the yarns used will make a very uneven finished result, because a light-weight fabric with fine yarns and plain weave shows up the quality of yarn about as prominently as is ever noted. The range of patterns which can be obtained from this method of printing is somewhat limited, though it undoubtedly gives an effect which is otherwise not possible. Smooth, round spots cannot be obtained by embroidery, swivel weaving or by any other method, so as to be as regular as those printed by this method.

GROUND FABRIC REGULAR.

There is little to interest consumers or manufacturers in the ground fabric upon which the printed pattern is placed. This fabric can be made in a good many plants and contains quite fine yarns and is woven with plain weave. An ordinary fine goods mill usually produces large quantities of similar fabrics when they are in demand, though recently the sale has been rather small. The cloth is purchased in the grey state and then bleached, afterward being placed upon it the printed pattern which is desired. Generally speaking, the ground fabric is no different from many of those similar cloths of a light character which have a rather stiff finish and are

SOLD IN THE WHITE STATE.

The production of such cloths is quite high at the loom because the loom speed is somewhat higher than for fancy materials and the percentage of production is also large, due to manufacturing conditions. Relatively, a large number of looms per weaver are operated because the filling will last for quite a long time and because the yarn is not subject to some of the strains which are noted in other styles of goods. Undoubtedly such cloths can be produced about as cheaply as any fabric in the market, all things considered, and many think that there is more economy practiced in the making of such goods than is noted for any other style of cotton fabric produced, not excepting the ordinary well-known print. This fact makes it possible for the converter or finisher to purchase the ground fabric upon which he is to place the printed pattern, for a rather low price.

FEATURES OF FINISHING.

There are a number of interesting features in regard to the production of these printed Swisses, the first being the process through which the material that is to be applied to the cloth is produced. The fibre which is used is often cotton, in the unspun condition, but due to the method of handling it has often been thought to be various kinds of wood pulp. Cotton or cotton waste is obtained, and this is ground very fine or into a powder by machinery made for the purpose. More than one process is used or until the cotton fibre has very little staple left, being more in the form of ordinary light dust than anything else. Naturally, whenever colored patterns are to be produced, the fibre is dyed, but this is immaterial in the description of the

PRINTING OR PRODUCING

process. The dyestuffs necessary would be those ordinarily used for dyeing cotton cloth or yarn. The next feature of interest is in regard to the design making. The pattern sketches, of course, would be made up just the same as when other styles of printed patterns are to be made. This radical difference, however, is noted. The ordinary pattern, as applied to a cotton fabric is engraved upon copper rollers, one roller for each color in the pattern. In this sort of printing no rollers are used, but rather an endless band of quite thin copper. The pattern is laid out upon this endless copper band, and instead of being eaten partway into the copper as is noted when rolls are used it is cut clean through the endless copper band. There is very little to explain regarding this feature. Most of the patterns on the bands are cut through with a dye or in some other manner, whereas the pattern upon the roller is eaten out with acid. The shellac which covers the copper roll almost entirely when immersed in the acid would not be suitable for the endless copper band, inasmuch as the band is not stiff,

but rather flexible. It is just as necessary to have the patterns repeat in the length of copper band, as it is in the circumference of the copper roll, and the

METHOD OF LAYING OUT

is just as accurately done. The circumference of the copper band is, however, usually very much greater than the circumference of the copper roll. The foregoing facts show clearly why continuous or scroll patterns are not used. In order to obtain a scroll or continuous pattern, it would be necessary to have a continuous cut lengthwise of the copper band and this would cut the band into various strips and they would not stay in their proper positions, thus causing insurmountable difficulties. The next interesting feature in regard to this process is that the fibre which is ground up is not stuck immediately onto the cloth. To obtain such a result a

PREPARATION OF GLUE

is brought into contact with the fabric through the holes in the endless copper band. This permits a pattern to be made or printed upon the cloth somewhat similar to an ordinary printed pattern though made of glue. Immediately after this printed pattern has been applied, the cotton cloth is sprinkled with the ground cotton fibre. This cotton fibre is agitated in the machine and is applied both to the back and face of the fabric and explains why the printed figure is raised on both sides of the cloth. The fibre sticks only to that portion of the fabric where the pattern of glue has been applied. Naturally, a certain amount of ground fibre is left upon the fabric, even though the glue pattern does not hold it, but this can be very easily removed by a blowing process or by brushing after the fabric becomes dried. The amount of fibre which is taken up depends a good deal on the amount of glue which is applied and the size of the spot printed. It is necessary that the glue does not spread or run, for if this occurs the design will not be what was intended and correct results will not be obtained. In order to eliminate this spreading tendency the fibre is applied to the printed cloth immediately after it has been printed and before the glue dries or spreads. There is a large amount of ground fibre in the air when such a printing process is being accomplished because the fibre is ground very fine and the material must be agitated quite extensively if it is to be applied regularly throughout the entire fabric width. It is always impossible to handle any fine material, similar to that described, without having a great deal of it in the atmosphere, especially when there is an excess of the fibre upon the fabric as it comes from the machine. It will be readily realized that the spots which are stuck on will not dry very quickly and for this reason a drying process is necessary. The cloth is hung up in large rooms in folds which run up and down much the same as is noted in certain of the piece-dyeing machines which are now being sold. This method of handling allows the air to circulate through every layer of cloth and keeps the damp spots from sticking to the folds which come next to them. If the cloth was folded at all tightly, or rolled up before it was dry the printed effect desired would be entirely spoiled, because one fold would have a tendency to stick to the fold next to it. The

MOST IMPORTANT FEATURE

in the whole process is the kind of glue or composition which is used in obtaining the spot. It must be a material which is affected very little by moisture or ordinary atmosphere conditions. It is also necessary for such fabrics to be washed at certain times and if an ordinary glue were used there would be no pattern or spots remaining after th washing process was completed. The method of obtaining the result is, however, very interesting, and at certain times is more or less desirable. The speed with which the printing can be accomplished is not so fast as is noted for an ordinary printed material for reasons which are obvious to most people, but it might be said a fast speed in printing would make it impossible to get the ground fibre stuck onto the cloth in a satisfactory manner, and would probably result in many seconds being produced

through one cloth coming in contact with a portion which had immediately preceded.

VARIETY IN FABRIC PATTERNS.

Among consumers there has been a prejudice in regard to the use of goods such as that analyzed, mainly because they have always been accustomed to having spots or figures of a woven character and are not willing to believe that the spots or figures will remain permanent when a washing process is employed. One of the objections which has been advanced against the use of this process is that although the spots remain firm when the fabric is washed there has been a tendency for the figures to turn to a yellow color when the goods are ironed. This is more especially true of the goods which have a white foundation and also white spots. It seems that the heat turns the glue or composition used into a yellow color and this makes a different-appearing spot. Of the developments in printing noted in recent years one of the most prominent is the various kinds of bordered goods somewhat similar to the embroidered and other styles of goods which have been in greater or less demand. These

BORDERED PRINTED PATTERNS

show up very strongly and it would seem as if they would be the nearest approach to certain of the embroidered crepes and similar fabrics of anything which can be produced in the domestic market. They surely produce a raised spot and the variety of patterns is quite extensive, though not as much so as in an ordinary printed material. The prices for the various fabrics depend upon their appearance, and inasmuch as special processes often bring large profits this is noted in the present instance, although it might be said that such fabrics offered when the demand is not large are often sold quite low and lower than the cost of production. The style of the result has much to do with the profit secured.

PATTERN.

80/1 Sea Island combed $\frac{2}{16}$ 2,236 $\frac{2}{16}$ = 2,300, total ends.

110/1 Sea Island combed filling. 60 picks per inch.

36 reed; 31½" width in reed, 30" width grey, 29¼" width finished.

76 X 60 grey count, 78 X 60 finished count.

YARNS.

	Cotton.	Labor, waste, etc.		
80/1 S. I. combed; 1 7-16" staple; 16 hank dou. rov.,	23½c.	28¼c.	=	51¾c.
110/1 S. I. combed; 1½" staple; 25 hank dou. rov.,	25c.	32¾c.	=	57¾c.

COST.

2,300 ends 80/1 S. I. combed warp + 4% take-up	= .0357 @ 51¾c.	=	$ .0185
60 picks 110/1 S. I. combed filling	= .0205 @ 57¾c.	=	.0119
Weaving			.0059
Expenses			.0051
			$ .0414
Selling (grey)			.0007
Ground fabric cost (grey)			$ .0421

Yards per pound 17.79 (grey).
Plain weave.
Retail price 12½c. per yard.
Printed with a bordered pattern.

THE MAKING OF YARNS.

Possibly one of the most interesting features relative to the ground fabric making is in regard to the yarns which compose the material. In order to obtain a regular effect it is practically always necessary for the cotton to be combed. This combing process eliminates a large portion of the short fibres and makes the yarn stronger and more even. It also permits finer sizes to be made than are otherwise possible. The yarns which compose the fabric analyzed can be made on either the spinning frame or the mule, though sizes much finer than those noted are usually made upon the mule. A much greater amount of care must be used in selecting the cotton and in the various processes employed if correct results are secured. The cotton fibre is seldom beaten as much in

the picking processes and the card draft is often much greater than for ordinary work. The

CARD PRODUCTION

together with the production of other machines is often quite a little smaller. At the spinning frame the production is radically smaller in pounds per week than for the yarns which compose most ordinary fabrics. Due to the fineness of yarns the variation in sizes is somewhat greater than is usually noted. For ordinary 40-1 a reasonable variation would be from 38-1 to 42-1, whereas for 80-1 the variation would be from 76-1 to 84-1, with other numbers in about the same proportion. There is no great difficulty noted in obtaining the weights of the yarns used or in the weight of the cloth as produced at the loom. The method is as follows:

2,300 ÷ (840 × 80/1) = .0343, weight of warp yarn without take-up.
4% take-up in weaving.
.0343 ÷ .96 = .0357, total weight of warp yarn per yard of woven cloth.

$$\frac{60 \text{ picks} \times 31\frac{1}{2}'' \text{ reed width} \times 36''}{36''} = 1{,}890$$

yards of filling per woven yard.
1,890 ÷ (840 × 110/1) = .0205, total weight of filling yarn per woven yard.
.0357 + .0205 = .0562, total cloth weight per yard.
1.0000 ÷ .0562 = 17.79 yards per lb. (grey).

"PIQUE" OR "MARSEILLES."

The quilted weave, as applied to cotton fabrics, is known among weavers as the "Marseilles" weave. It is a double cloth, the face being a moderately close, plain weave. The back is a very open, plain weave. Between the back and face a soft twisted heavy filling, called "stuffing," is woven. The two cloths are stitched together at frequent intervals in weaving, the stitches being arranged so as to sufficiently bind the two cloths together, and at the same time form an ornamental design or pattern. The "stuffing" between the cloths gives the fabric the embossed effect.

THE FACE

being plain woven is drawn into heddles as for sheeting. The back is also a plain weave, but the back warp is also the quilting warp, and has to be mounted in a "jacquard" harness, unless the pattern is small enough to be produced on a "dobby." Two face threads and one back (or quilting) thread are drawn into each dent of reed. The construction is shown in diagram, Fig. 1.

Two threads of face and one of back warp are drawn into each dent of reed. Back warp is on a separate beam, and contains one-half the number of threads that are in the face.

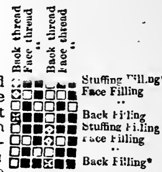


Fig. 1.

Indicates that the thread is raised by the Jacquard only when used for building. Shows same thread when raised by the comber board regularly to form the back. * Back filling same as face.

THIS CONSTRUCTION

calls for a loom with two shuttle boxes at each end of lathe. Large patterns require a "jacquard" attachment, while the small designs may be made on a dobby head; also two warp beams are necessary. In operation the loom throws in one back, two face and one stuffing pick in regular order. To make the embossed effect show up well the back warp is woven with considerably more tension than the face.

AS AN ARITHMETICAL BASIS

for the construction of this fabric, about 11 times the square root of the average hank number on face and back may be used. The "stuffing" should be four times as heavy as the average number used for face and back. On this basis a Marseilles quilt or counterpane, if woven with average No. 35 on face and back, and No. 8¾ stuffing would have:

64 threads	per inch of No.	30	warp on face.
32 "	" " " "	30	" back.
64 picks	" " " "	42	filling on face.
32 "	" " " "	42	" back.
32 "	" " " "	8¾	" as stuffing.

and if woven 12 quarters square, would weigh about 3 9-10 pounds per quilt; or take a 30-inch vesting fabric, made of average No. 80 yarn on face and back and 40 stuffing. The stuffing yarn in this case is only twice the weight of the face, but there are twice as many picks relatively thrown in. There is no back filling used in vest-

ings. The back, when not used in quilting, is floated. The organization would be:

98 threads per inch on face.
98 picks " " " " Average No. 80.
98 " " " stuffing No. 40.

The picks are thrown in two face and two stuffing regularly. At 30 inches wide the goods would weigh 4 65-100 yards per pound.

IN THIS EXAMPLE

the average number of the face yarn is given. The fabric looks and wears better if warp and filling on face are alike, but it helps the weaving out wonderfully to have a considerable difference between the two, the warp being from 10 to 20 per cent heavier than the filling.

It is beyond the scope of an elementary article like this to attempt any description of the means used to produce the ornate designs of the fabric. The artist who originates textile designs must draw each design to fit the fabric he is dealing with. Each fabric has its special characteristics as to design, and each also has its limitations. The characteristics and limits of the fabric under consideration may be here stated.

COLOR EFFECTS.

1. Color effects are hardly admissible. The fabric is essentially a white one. The quilting warp is sometimes colored, so as to show a pattern composed of colored lines and dots on a white ground. The design is not thereby altered, for the pattern woven with colored stitching may also be woven entirely white.

2. The fabric admits only of a design of "dots" arranged to produce large designs.

3. In the vestings and fabrics with small patterns, the quilting warp threads, when not raised to make a stitch, are floated. The dots then should be arranged so as to avoid very long floats.

4. On counterpanes the design has to be very large, and has to be produced on a "jacquard" machine of comparatively small capacity. This calls for a design that can be enlarged in the tie-up of the harness and to this end certain parts of the design are arranged so as to admit of several repetitions.

THE NAME "PIQUE"

is now generally applied to this fabric when woven in small patterns within the capacity of the "dobby." This name particularly applies when the goods are to be used for ladies' and children's dresses, men's shirt fronts, etc. However, the fabric that is called "pique" when used for dresses or shirt fronts would be a "Marseilles" if made up into a man's vest. The name "pique" is probably from the French "piquer," to quilt or prick with a needle. Possibly the name "Marseilles" is also a corruption of the French "matelas," a quilt or mattress.

A CORDED "MARSEILLES,"

or "pique" is essentially the same fabric as the figured article, but is woven rather differently. The warp is drawn into a three-shed harness like a common three-shed twill. To produce the corded effect the harnesses are operated by a dobby. Two warps are used as in the preceding cases, one warp having twice as many threads as the other; the quilting warp is drawn into the back harness, the face warp in the middle and front. The pegging plan of dobby chain is shown at Fig. 2.

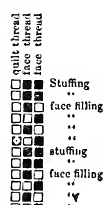


Fig. 2.

As this weave calls for four picks of face filling and two picks of stuffing in succession, the lathe need only have drop boxes on one end.

QUILT WEAVE GOODS

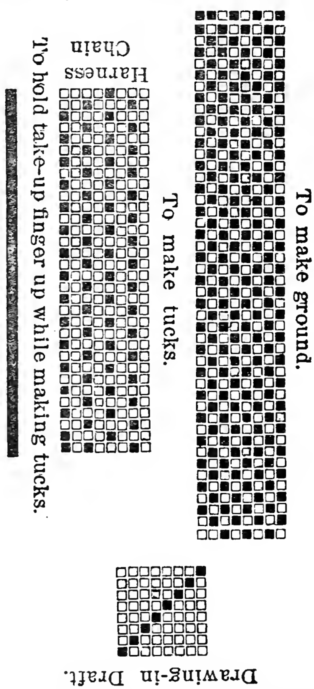
should be finished so as to preserve, as far as possible, the convexity or puff of the quilting. To this end, after bleaching and sizing, they should be dried on tenter-hooks. The piece

goods can be dried on the tentering machine, through which they should run face down. The quilts or counterpanes are handled singly, and are stretched on square tentering frames and dried in a hot room. There is a fabric on the market called "P K," which is often confounded with "pique," the names having the same sound. "P K" is a float weave and the fabric bears no relation to "pique" or "Marseilles."

TUCKS

Cotton Wash Fabric.

A tuck fabric is a single cloth and is made by using two or more warps, is generally composed of all cotton,



cotton and silk, and all silk, and can be made on any loom having either a dobby or a jacquard attachment, and single or double box, double box looms, of course, giving great scope for filling patterns.

A tuck effect in a cloth is a perfect pleat running across the cloth from one selvage to the other and was used extensively a few years ago in making fancy bosoms for men's outing or neglige shirts and ladies' waisting, very elaborate effects being produced by weaving ground cloth in colors either harmonizing with or contrasting to that of the tuck.

Two different numbers of filling are used in this fabric, namely, a fine one for the plain ground or flat part of the cloth, and a coarse number for the tuck, as the tuck is a filling effect, and the coarse filling causing it to stand out more prominently from the ground fabric than would be the case if fine numbers of filling were used to form the whole fabric.

In making a common tuck effect two beams are necessary, also 10 harness or heddle shafts. The top beam containing the tuck warp is drawn in on the 2, 4, 6, 8th harnesses, and the bottom beam, containing ground warp, is drawn on 1, 3, 5, 7th harnesses, the other two harnesses to work independently for selvage, plain weave being used all the time.

The harness or head chain is pegged to work all the harnesses plain weave at the same time for whatever length of plain ground is desired in the cloth being woven. "For example, if you want 40 picks plain ground cloth before weaving" the tuck, simply peg the chain plain weave on all harnesses for 40 picks. Then to form the tuck peg the chain so as to work only tuck harnesses for plain weave for number picks necessary to give length of tuck desired, the ground harnesses being at rest.

While the tuck harnesses are working, the take-up motion is temporarily dispensed with by coupling the take-up finger to a jack in the head motion by running a strap over the top of the loom and down the side. After having woven the desired number of picks to form the tuck, as the loom turns over, all the harnesses are set working plain weave, and as the first pick of the chain operates the head motion, the take-up finger drops, the take-up motion is again in gear, and the reed beats in, the pick binding the turn and

throwing it out from the ground fabric.

This fabric is generally made to finish from 2½ to 3½ ounces and 27 inches wide.

CONSTRUCTION COMMON TUCK.

1,300 reed, 2 ends per split, 1 end per heddle, 29 inches width in reed, including selvage; 1,036 plus 16 splits, 2,072 plus 64 ends. Ground warp and tuck warp, 1-40s cotton; 70 picks per inch 1-40s cotton filling. 7 per cent shrinkage in width in weaving and finishing; 10 per cent shrinkage length finishing and weaving.

Tuck pattern: 46 picks 1-40s cotton for plain ground; 32 picks 2-20s cotton for tuck. Selvage, 4 in a heddle and split. Finish about 3½ ounces.

SCRIM

Scrim. A loose woven, flimsy-looking cloth, composed entirely of two-ply cotton yarn, both warp and filling, and resembles a fine meshed fish net.

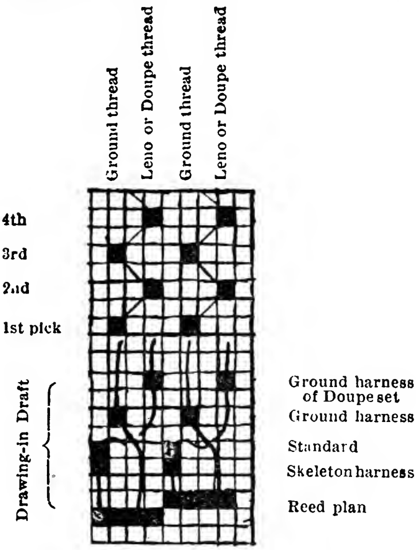
Scrim is usually made in bright colored stripe and plaid effects. It is peculiarly adapted to the draper's art, as it is a light-weight creation, therefore soft and pliable; it is also used as a fly net for horses in the summer time.

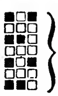
Scrim is made of 2-20s cotton, dry color, in both warp and filling, and as a fabric requires nothing in the nature of a finish except being run through a hot press, simply to smooth the wrinkles which may occur during the process of weaving.

By using 3-10s and 4-10s cotton warp and filling, and, of course, in proper proportions, we produce hammocks and material for laundry bags with this same scrim weave, or, to be correct, gauze weave. Scrim can be woven in any power loom, but best results are obtained by using a light running loom. The

SCRIM WEAVE OR LACY EFFECT

can be produced by using a regular doupe set of harness, but the best, quickest and cheapest method is by using an attachment known as the Ashoff motion, which is an improved set of harness or heddle and heddle shafts built especially for this kind of effects in cloth. This motion consists





Harness chain.

This weave applies to a fabric (scrim) in which the Doupe set is working every pick, and each Warp thread working with a mate thread, and producing perfect Leno effect.

NOTE.—In drawing in the Ground thread crosses over the Doupe thread.

of two heavy wooden frames built similar to heddle frames and suspended in the loom from the top roller, in the manner in which old roller looms were equipped for weaving gingham.

In place of heddles these frames are filled with a coarse reed, in accordance with number of splits per inch required for fabric; these reed dents are plugged with lead, alternately top and bottom, and two ends are drawn straight through both harnesses.

THE ASHOFF MOTION

makes a shed in the regular roller loom style or by treddle or cam, and has likewise a sideway movement,

which is obtained by placing a small eccentric on the bottom loom shaft.

Near the side of loom this eccentric is connected by a one-half inch iron rod with a pair of bevel gears which are fastened on the loom frame at a point equal to the center of the shed. These gears are in turn coupled by smaller rods to the heddle frames, and create the side motion, which allows the threads to operate in a sort of rolling motion or, in other words, each thread rolls half-way round its mate thread and the filling pick, binding it in, and on the next pick the roll is reversed, and this creates the lacy effect. In addition to the motion mentioned, there are various styles of patented heddles now used for weaving what is known as ordinary gauze, or where the two leno threads change every pick. In some cases these patented heddles are constructed upon a sliding sleeve idea, where the center of the heddle slides up and down, and inasmuch as it holds the leno thread, it makes a crossing when this occurs. In other instances, the heddles are somewhat similar to the ones ordinarily used, but the doup is also made from steel, and in certain cases these have given better results than older methods. Possibly there are a half-dozen or more of these patented heddles, which are sometimes used in making leno fabrics. Use regular 2-20s cotton yarns and set the warp about 44 inches in the reed, 20 ends and 20 picks per inch; will weigh about 1½ ounces and measure about 36 inches wide from loom.

FOR LAUNDRY BAGS

use 4-10s cotton in the gray; set 30 inches in reed, three ends and three picks per inch; will run 25 inches from loom; no finish.

In hammocks very elaborate effects are made up with the scrim weave as applied to the harness loom. Diamond twill and fancy colors are a favorite combination and make a good selling line.

4-10s cotton yarn (warp filling); 42 inches in reed; 14 ends per inch; one end per dent; 14 picks; stripe patterns. No finish, as cloth is made into hammocks straight from loom.

HAMMOCK CRASH

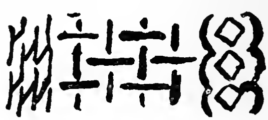
This cloth, as the name implies, is used in the making of hammocks. It is made strong and durable to stand the strain and wear that it is subjected to and can be woven on almost any ordinary loom. It is generally made in three grades, viz., best, medium and low.

The best grades are generally made on the jacquard loom, so that very elaborate patterns may be introduced.

A 400 tie-up is generally used, but any tie may be used according to the requirements of the design and quality of the cloth.

The warp is generally composed of three or four or more colors of yarn, the colors being very bright and contrasting, such colors as green, red, gold and black taking a prominent part.

The design is generally an extensive and elaborate one and in stripe form, but designs of the following character are sometimes employed, with particulars as follows:



Warp: $\frac{3}{8}$ cotton, as sample, 20 ends per 1 in., 10 x 2 reed, 46 in. wide in reed.

Filling: $\frac{3}{8}$ cotton, as sample, 18 picks per 1 in.

The warp is woven with an even tension and where a gauze or leno weave is used, two or more beams are necessary and the necessary slackners, etc.

When the warp is composed of several colors of yarn, the filling is generally used undyed or in one solid color.

Semifancies (generally of medium quality) and plain or lower grade cloths may be woven on harness looms (16 to 24 harnesses being employed). Plain or lower grade cloths are sometimes woven in looms having a cross-weaving or gauze-reed attachment

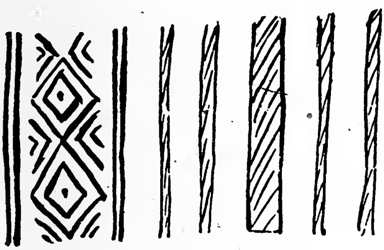
when the weave is a gauze or leno, which is generally the case.

These cloths (medium grade) are not made as strong and compact as the first quality, the particulars being as follows:

Warp: 14 ends per 1 in., $\frac{3}{8}$ cotton, 7 x 2 dent reed.

Filling: 12 picks per 1 in., $\frac{3}{8}$ cotton.

The weave is generally a semifancy one, that is, plain weave for 2 or 3 in., and then a gauze stripe or gauze stripes at irregular intervals across the warps. The colorings in warp are similar to the first grade colorings, and the design is less elaborate, sometimes on the following order:



Repeat several times.

The cheapest qualities are much lighter in weight and more open in texture, the particulars being as follows:

Warp: 8 ends per 1 in., $\frac{3}{8}$ cotton, 8 dent reed x 2; mess every other dent.

Filling: 7 picks per 1 in., $\frac{3}{8}$ cotton.

The weave is generally a gauze one, one that is largely used, being 3 picks plain and 1 pick gauze.

This quality is often made with undyed cotton warp and filling and is dyed in the piece a solid color. It may also be made with colored warp threads, but on account of the scarcity of warp threads less effective results are obtained than in the first two grades.

A typical sample is herewith enclosed, but is a little better quality than the particulars given refer to.

These cloths are generally made by manufacturers who make up their own cloths into hammocks and sell in this form.

They require no finishing, as they are made up into hammocks in the condition as taken from the looms, except in cases where the goods are to be dyed.

In making hammocks, hangings or draperies are employed and these cloths are closely related to the hammock cloth. They are made on the same looms as hammock cloths and are of the same texture.

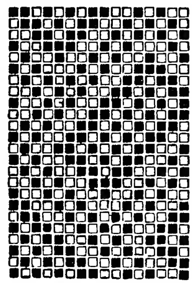


Fig. 1.

The yarn used is the same generally, but the cloth need not be as strong as the body cloth. The ends and picks per 1 in. may be a little lower. The drapery cloths are made two in a width, there being 12 in. or 14 in. of the reed empty between the two cloths. The filling is thrown across in

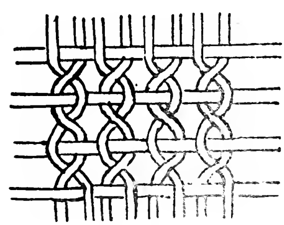


Fig. 2.

the regular manner, and when the cloth is woven, the filling is cut in the center of space between the cloths, and the ends thus formed constitute the fringe of the hangings, which fringe is knotted in various ways to make the hanging more effective.

In order to secure the warp threads at the inside edge of drapery while

weaving, the two ends nearest the fringe side are made to cross each other in weaving and make a firm selvage for the actual cloth.

The warp yarn may be either in colored stripe form or solid color, and the filling solid color, or both warp and filling, may be in undyed state and dyed in the piece when woven.

The draperies are made to match the body, similar colorings and designs being employed.

WEAVES TO EMPLOY.

The best qualities have generally jacquard effects, and as the texture is not so compact, the plain weave must be used extensively in ground, the figure being either 5 harness satin or 3—1 twill.

The medium qualities as made on harness looms have weaves as shown in Figure 1, the plain weave being conspicuous in order to make a firm cloth.

Low grade cloths are made almost exclusively with the gauze weave, Figure 2 being a typical one.

MADRAS

Madras is a light-weight cotton cloth, composed of all cotton or cotton and silk, and is a single cloth fabric, having excellent wearing qualities.

It has been on the market for many years and is considered a staple in the cotton goods line. It is a narrow fabric sold at 27 inches wide, and is made of varying grades, weighing from two to three ounces per yard, and is used at all seasons of the year. It is used by the ladies for summer skirts, shirtwaist suits, etc.; by men for shirts, shirt bosoms, and four-in-hand and bow neckties. It is also used as a drapery in workmen's homes for windows, etc.

It is known by the plain white ground and fancy colored, narrow stripe warp effects, and is made of cotton yarns ranging from 1-26s to 1-80s warp and filling, and from 50 to 100 or more ends per inch. The knowledge of the utility of madras being common among most all classes of people, permits of the greatest scope in creating both harmonious and contrasting colors and weave combinations, simplicity in color arrangement being generally the keynote to success in producing an elegant, good-selling line.

COLORS.

Those colors most in demand, which have been adapted to this fabric, are rich and delicate shades of blue, rose, green, linen, tan, lavender, ecru and bright red.

For prominent hair line effects use black, navy blue, dark green, royal blue and cherry red. Good fast color is necessary in making madras, as it is a wash fabric, the feature of which is the fine colored stripe effect running warp ways.

If inferior colors are used, they will surely spread during the finishing process, and will cause a clouded stripe where a distinct one was intended, thereby causing a pile of seconds. Madras used in making men's stiff bosom shirts, which retail at $1.50 and upward, in most cases is made entirely with a plain weave.

Sometimes the colored stripe is developed by doubling up in the heddle and reed (by drawing in two or more ends in one heddle, and the threads of several heddles in one split in the reed).

ANOTHER METHOD.

Another method is to weave the colored warp threads on other harnesses than those of the body of the cloth, using a twill weave on these harnesses, and by doing so create a perfect cord in the cloth.

High-grade patterns are usually formed by making a plain white stripe from ½ inch to 1½ inches in width, and the colored stripe of 2, 4, 6, 8 ends. In using any of these numbers of ends, the width of the colored stripe is governed by the fineness of reed, and method of drawing through the reed, consistent with the weave effect desired.

Fancy madras is made more successfully on the dobby loom, 20-harness capacity covering most all combinations used in this line.

A good grade of madras is made by using 1-30s cotton warp and filling.

1,200 reed, two ends per dent; 31½ inches in reed; 56 picks, 1-30s filling; finish, 27 inches; weight, 2¾ ounces.

WARP PATTERN.

14	White	1-30s	Plain weave.
1	White	2-40s	
14	White	1-30s	
4	Rose	1-30s....	Basket weave.
10	White	1-30s....	Plain weave.
4	Green	1-30s....	Basket weave.
47			

Finish for madras: Run through washer, cylinder (to dry cloth), tentering machine, calender or press.

Finishing Particulars.

Starch, 6 ounces cornstarch, 2 ounces white cocoanut oil softening, 1

1 per cent new methylene blue G G, ½ per cent thioflavine T. Wash well.

PINK.

Mordant yarn with 2 per cent tannic acid. Give 5 turns and fix with 2 per cent tartar emetic. Wash well. Dye 9 ounces acridine red 6 B., 3 ounces rhodamine 3 G. C. Bischoff & Company. Wash well.

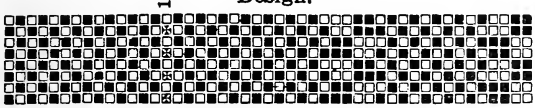
GINGHAM (Common)

Gingham (common) is a single cloth composed entirely of cotton and always woven with a plain weave; it is the most universally known fabric on the market and is made in various grades, having from 50 to 76 ends per inch in the reed and of 1-26s to 1-40s cotton yarns in both

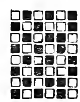
1 end 2-40 cord.

Design.

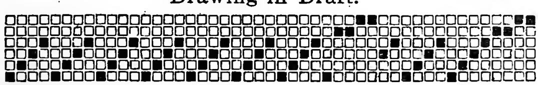
One repeat.



Harness Chain.



Drawing-in Draft.



Reed Plan.

Note—Design is two repeats in filling, and is intended to show connection between first and second repeat.

gallon water. Calender with light calender machine.

Dyeing Particulars for Madras.

Following are dyeing particulars for good madras shades:

LIGHT GREEN.

Mordant yarn with 2 per cent tannic acid. Give 5 turns and fix with 2 per cent tartar-emetic. Wash well. Dye

warp and filling. It is a wash fabric, made in both check and plaid patterns, into which an almost unlimited variety of color combinations are introduced. It is most commonly used in the manufacture of ladies' and children's aprons and summer outing dresses.

It can be woven in any power loom having a box motion attached, using four-harness or heddle shafts, and having as a selvage eight double ends on each side.

There are many mills which are now using automatic looms for the production of ordinary ginghams. Of course, the advantage gained is not quite as large as when ordinary grey fabrics are being produced, but, relatively, it places a manufacturer in an advantageous position, as far as competition is concerned. Undoubtedly, a great many more of these looms will be used in the future, the only great reason why more of them have not been installed being because of the limited finances of various concerns and the fact that many manufacturers are opposed to throwing out any machines which seem to be giving satisfactory service, even though the cost of production is rather high.

Gingham warps are made in two lengths, 720 and 1,080 yards, and these lengths are subdivided into shorter lengths or cuts, usually 14 and 21, respectively.

When a gingham warp is woven out the set of harnesses or heddles are taken out of the loom and placed in a twisting frame and twisted, an operation which means the fastening together, by means of the fingers, of those ends remaining in the set of harness, and those of the new warp. A practiced operator can accomplish this work at the rate of 50 to 60 ends per minute, and he is generally a boy of perhaps 16 years of age.

Loom fixers each have a section of looms, numbering about 60, to care for and keep in good running order.

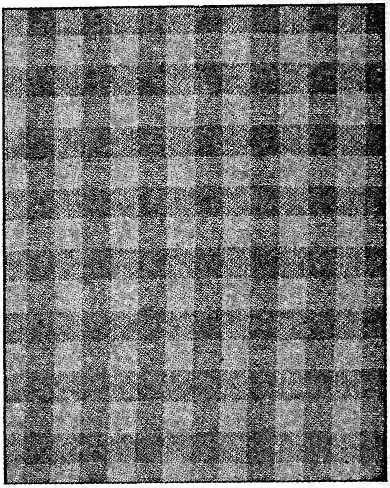
FINISHING GINGHAMS.

The goods are taken from the loom and conveyed to the wareroom, and the ends of several pieces or cuts are sewn (chain stitch) together on a sewing machine, thus making a continuous length of cloth of several hundred yards, about 300 yards. (This is done to facilitate handling.)

It is now run through the sprinkler, the object of which is to dampen the cloth in such a manner as to improve its receptive qualities in the sizing operation.

The sprinkler is a machine having a box arranged on its top. Through this box is passed a roller having bristles set on end at regular intervals, similar to the brush in a carpet sweeper; the box is fed with water by means of a small pipe, and the cloth on entering the machine passes over the roller brush, which in revolving comes in contact with the water, and spreads it over the cloth, which is drawn through the machine by means of delivery rollers at the opposite end.

From the sprinkler, it goes to the size tubs, where it is given a good amount of starch sizing. It is next run through the cylinders to dry it, and then run through the tentering machine, which operation is a continuing of the drying process, also stretching the cloth in width. It is then passed through the calender, which is a sort of hot press, and in which operation it is smoothed, and receives the desired glaze on the face of the cloth. From the calender the cloth goes to the lapping machine, where it is rolled around a small wooden board, known as a lapboard, the operator making a bolt of each cut of cloth, the length of which is governed by the subdivision of warp.



Gingham.

After the lapping operation, the cloth, which is now in the shape of a bolt (commercial term), is taken by the folder, who unravels a couple of yards and doubles it up, and neatly

rolls it back in place, while he tucks in the ends. The bolt is then stitched with a strong cord, twice through each end; the ends are then singed with a gas flame to remove odd scraps of filling threads. The bolts of cloth are then placed in a plate press in the following order: three or four bolts are laid flat side by side in the press, and a zinc or other metal plate placed upon them. This is repeated until the press is filled with desired number of pieces or bolts, the top of the press is then run down by means of a belt connecting with a driving shaft, and the goods allowed to remain in this condition several hours, after which the paper bands are placed around them and they are ready for shipment. The following is a list of standard gingham patterns, known as two shuttle checks and usually made in blue, brown, green, black and red.

Warp and filling: 2-2, 4-4, 6-6, 8-8, 10-10, 12-12, 14-14, 16-16, 18-18, 20-20, 24-24, the pattern reading:

2 Blue	or	24 Blue	Warp and filling.
2 White		24 White	

For side pattern effects use same colors:

4—2, 8—4, 6—4, 10—6, 20—10,

10—6—2—6

8—4—2—4

6—4—2—4

Read in this manner:

10 Blue	Warp and filling.
6 White	
2 Blue	
6 White	

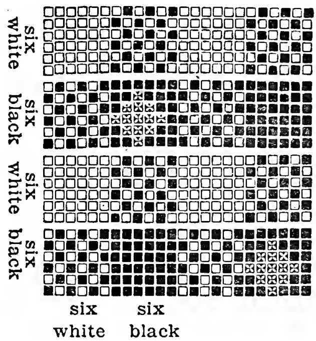
Staple ginghams are known to the mill man as 900, 1,200, 1,400, meaning 900 reed, 1,200 reed, 1,400 reed. Those made with a 1,400 reed are usually intended as an imitation of zephyr ginghams.

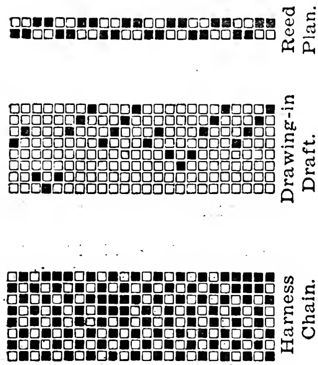
A good grade of ginghams can be made thus: reed, 900—two ends per dent; 29 inches in width; 44 picks filling. Finish, 27 inches. Check pattern. Weight about 2.1 ounces; 1-26s cotton warp and filling. Plain weave.

A better grade thus: reed, 1,200—two ends per dent; 29 inches in width; 52 picks filling. Finish, 27 inches; weight 2¼ ounces; 1-30s cotton warp and filling; generally stripe patterns; plain weave.

A fine grade thus: reed, 1,400—two ends per dent; 29 inches in width; 60 picks filling. Finish, 27 inches; weight two ounces; 1-40s cotton warp and filling. Check or plaid pattern, plain weave.

Design.





Design represents weave and color effects in spotted check gingham.

Ginghams are made with from two colors, warp and filling, to eight colors in warp and six in filling.

The 1,200 grade is occasionally made up in spotted check effect or say six black, six white, having a small diamond-shaped figure at regular intervals, produced in dobby looms.

Another style having great vogue some 10 years ago is known as apron ginghams, made in 900 grade, and hav-

ing about three-quarters of the width of the cloth woven in a small check, 4x4, and the remainder having a large pattern, with a woven check in the filling. It is usually made in two colors, and made 36 inches in reed.

Reed 900—two ends per dent; 36 inches in reed; 44 picks filling. Finish 34 inches; 1-26s warp and filling. Plain weave.

Warp pattern.		Filling pattern.
4 Blue 4 White	168½ times = 1,348 ends.	4 White 4 Blue

8 Blue
2 White
6 Blue
10 White
10 Blue
22 White
10 Blue
10 White
6 Blue
2 White
52 Blue
2 White
4 Blue
10 White
2 Blue
16 White
2 Blue
10 White
4 Blue
2 White
40 Blue

Read from top to bottom then reverse.

= 222 ends × 2 = 444 ends in border
1,348 in ground
1,792 + 8 ends blue

Blue for Ginghams.

Following are the dyeing particulars of a good blue for a gingham (common).

For 100 pounds yarn, 1st bath: 6 pounds immedial indone 3B cone; 12 pounds sodium sulphide crystals; 4 pounds grape sugar (glucose); 3 pounds soda ash; 4 pounds common salt.

For standing bath: 3 pounds immedial indone 3B cone; 6 pounds sodium sulphide crystals; 1½ pounds glucose, pound soda ash.

Immedial indone 3B cone is one of the Cassella Color Company's colors. Should a bluer shade be required, a little immedial indone B cone can be added. If a greener shade is needed, a little immedial yellow D can be added.

Dye for one hour, turning the goods several times, then squeeze off well by means of the squeezing rollers attached to one end of the vat, and level by wringing off rapidly at the wringing post.

Then age the yarn three-quarters of an hour, rinse well and soap if required. Uniform and careful squeezing and wringing off are essential to ensure good levelness of the dyeings.

Immedial indone 3B cone and B cone are excellently suited for the production of every shade of indigo, both for light shades when dyed by themselves, and for medium and darker shades when dyed in combination with immedial direct blue, or the other brands of immedial indone. By reason of their simple method of application they deserve the special attention of all branches of cotton dyeing.

FINISHING FOR GINGHAMS.

Starch: 2-8 ounces cornstarch; 4-8 ounces white softening; 1 gallon water; mix cold, boil half an hour.

White softening is from cocoanut oil. Pieces are run through a starch mangle and onto a cylinder drying machine. They are then damped on a sprinkler machine and given a light calendering.

CRASH

Crash is a single cloth fabric, composed of all-cotton yarns, or of cotton and jute. It is used principally for toweling and as a covering for fine carpets. In some of the southern states it is made with a plain weave, and worn as a summer men's wear fabric, as it is cheaper than linen.

It is usually made of 1-14s, 1-16s, 1-20s cotton warp and filling, and sometimes of 1-10s and 1-12s cotton. As a carpet covering, it is woven in a narrow loom, and has either broad or narrow stripes in the warp, of fancy colored dyed yarns, dark red and dark blue being common colors. The ground of the cloth is made of cotton yarns in the gray, or unbleached state. This fabric has the

APPEARANCE OF LINEN,

due to the heavy sizing, and calendering in finishing. Small warp effect twill weaves are used, such as 2—1, either right or left hand, and running at 45 degrees, 1-16s cotton warp and filling crash toweling is made of yarns both in the grey and bleached

state, generally about 1-14s cotton warp and filling, in widths varying from 15 to 24 inches finished, either all bleached or with side and cross borders, or in what is known as

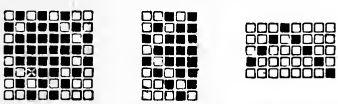
HAIR-LINE PLAIDS.

Rarely any colors, excepting red or navy blue, are used in toweling. The same weaves are used in this line as in ordinary linens, namely, the plain weave or 1 up and 1 down, in the commoner grades. But for bathing purposes, where a rough toweling is sometimes required, there is the bird's-eye or huckaback weave—also the eight-end

HUCKABACK DESIGN.

Design Drawing-in Draft Reed Plan Harness Chain

HONEYCOMB DESIGN.



Design Harness Chain Drawing-in Draft

Reed Plan

honeycomb weave. Toweling, having as a design floral or scroll figures, is made on narrow looms, having a jacquard machine attached; this sort is used for bureau scarfs.

Crash can be

WOVEN ON ANY POWER LOOM.

The kind of loom necessary to produce any certain grade of crash is governed by the construction of weave effect desired, as, for instance, either the plain or twill weave effects are best adapted to the roller or cam loom; the more complicated fancy weaves, such as huckabacks and honeycomb, necessitate the use of a dobby loom.

TO FINISH CRASH,

it is first run through a sprinkler, to dampen it; then it is put through the size tub and rather heavily sized, after which it is run through a dryer. From the dryer it goes to the calenders, in which machine the gas-heated top roller acts upon the sizing and produces the rather glazed effect on the face of the cloth.

Crash toweling using huckaback weave: reed 850, 2 ends per dent; 18 inches wide; 1-16s cotton warp and filling (bleach); 46 picks of filling; finish 16½ inches; weight, 1.85 ounces.

To make a softer feel, use one-half number of picks and wind 1-16s and 1-20s (1 end of each) on same bobbin, and weave it in; this also increases the mottled effect.

Crash toweling using honeycomb weave; reed 850, 2 ends per dent; 20 inches wide; 2-20s cotton warp and filling (bleach); 44 picks of filling; loom width, 16 ounces; no finish; weight, 3¼ ounces. Use dobby loom for each of these fabrics.

In making honeycomb toweling, if using a cross border, the Crompton double cylinder or two-weave dobby is the most convenient, as the border weave and the body weave each has its separate harness chain, and is worked from the box chain.

THE FINISHING.

Detailed Description of the Process of Crash Finishing.

To finish a piece of crash ready for the market: If the piece is clean enough and a cheap, rough finish is required, the first process is starching. A very light starch liquor is necessary, to one gallon of water, two to six ounces of cornstarch, one-half to one pound cocoanut oil softening. Mix in cold water and boil together for 30 minutes. The pieces are passed through a starch mangle at full width, over a drying machine of steam cylinders. They are then passed through a light calender to straighten the goods out, and smoothed down a little. They are then folded up, packed in cases and shipped away.

The goods can be bleached, each piece being placed separately in a kier, or the ends sewed together and the goods run into a kier, with a 4 degree Tw. solution of caustic soda, and boiled six to eight hours.

The goods are then run through

A WASHING MACHINE

and returned to the kier, and the soda boil repeated for eight hours. The goods are run through a washing machine, and through a solution of oil of vitriol ½ degree Tw., washed again, and run through a solution of chloride of lime at ½ degree Tw., piled in a bin for eight hours, run through an acid solution of oil of vitriol ½ degree Tw., and well washed until all trace of acid is eliminated. If any acid is left in the goods, the goods, being very heavy, will be tender, as they will retain so much acid when dried on the drying machine that they will have the fibre of the cloth injured. The goods are then starched with four to six ounces to a gallon of cornstarch, one-half pound cocoanut oil, white softening. This is to add a little fullness to the cloth without making it too stiff and starchy. The goods are then dried on a tenter frame at full width, to keep them straight and have the weft perfectly straight across the piece.

If required, they are then given a light calendering. If a light buff or ecru is required, a little color is added to the starch liquor, or the goods are dyed on a jigger machine, or on a padding machine.

These goods will stand a great amount of wearing, and look dressy and chic, without being too expensive.

DOMET OR OUTING CLOTH

Domet, or outing cloth, is a single cloth, composed of single cotton yarns, generally 1-20 to 1-26 warp yarn, and 1-14s or 1-16s cotton or cotton and cotton shoddy mixed filling yarns. It is made in bright colored stripe and plaid patterns, and is used in the manufacture of shirts, pajamas, etc., and is always woven with a plain weave, or 1 up, 1 down.

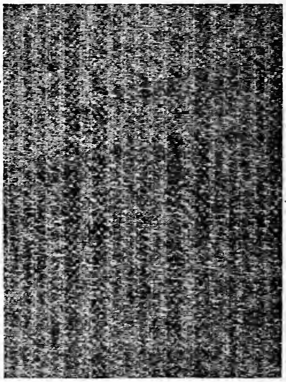
In effect it is a fabric having

A SOFT, REGULAR NAP

on both sides of the goods and in appearance is very similar to a flannel.

The nap is produced by carding or brushing up the loose outside fibres on a rather slack twisted filling yarn, by running the cloth through a napping machine.

The napper is a machine consisting of a series of woolen rollers, through which the cloth passes, as the machine is working automatically. The brush roller, that part of the machine which raises the nap, is a wooden cylinder covered with wire card clothing, and is in fact the same as a fancy on a woolen card. This brush roller is set on the top of the machine near the center, and is so arranged that the cloth passes between it and a wooden or other solid roller or cylinder, and as the brush roller revolves, the wire teeth in the card clothing come in contact with the surface of the cloth and as they are running in opposite directions, the filling being the softest, the natural result is a nap being raised.



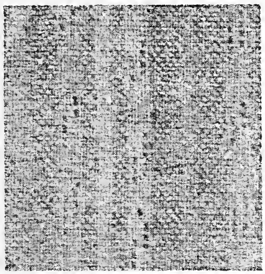
Domet.

A domet fabric may have either a high or long nap, or a short or close nap.

THE DEGREE OF NAP

to be produced is governed first by the experienced judgment of the manufacturer in buying a filling yarn which will produce the best results, namely, a fine nap, with minimum loss of strength as a thread, as a knowledge of the amount of filling twist and in a given count, less the percentage of twist, to create proper degree of slackness in the yarn, is found convenient when buying this kind of yarn.

Domet is generally made on a roller or cam loom, as a cloth receives NO FINISH, EXCEPTING THE NAP. The selling width of the cloth is about 29½ inches. During the process of napping, a domet loses a small percentage of the filling weight. This waste is called fly, as it is used by



Domet.

shoddy manufacturers in the production of heavy backing yarns.

Warp colors used in domet stripes. dark blue, light blue, light brown, pink and light green.

Filling: all white for stripes, and in some grades, cotton and cotton shoddy mixed yarns give the fabric a dark tone, after the napping. The last-named grade is used extensively as a working shirt for machinists, as it doesn't show the soiled places very readily, and will tear easily if caught in the machinery.

Warp stripe domet: reed 800; 2 ends per dent, 31½ inches, 1-22s cotton warp yarns, 36 picks.

1-16s cotton filling, 11 turns twist (will produce good, close nap).

Selling width 29½ inches.

Plain weave on four harness; drawn-in 1, 2, 3, 4.

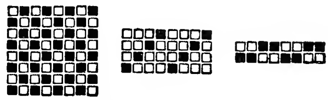
Weight, 2.3 ounces, about.

Amount of filling twist, less about 15 per cent, will give good results in napping.

Filling loses about ¼ per cent of its weight during napping process.

Carding Particulars.

The raw stock used for these goods should be American of about 1 1-16 inch staple. The usual plan of mixing the cotton is followed of having the mixings as large as possible, but no other special attention need be given



Design. Drawing-in Draft. Reed Plan.

to it. At the pickers the only special feature to look out for is

THE SPEED OF THE BEATER.

This should be run at above the average speed, because the cotton used generally contains more than the average amount of dirt, etc., found in cotton. The weight of the lap at the front of the finisher picker should be heavy. At the card the only special features to be careful of are the settings. These should be open because of the weight of the lap put in at the card and also because the production of this machine with this class of goods is large. The most special attention given to this class of goods is at

THE DRAWING FRAME,

three processes being the usual number run. The most important points to look out for are as follows: that the settings are all right, the top leather rolls are properly covered, and that they have no channels or are not hollowed out along their entire length, that the top rolls are kept properly varnished, that the stop motions are properly adjusted, and lastly that the condensing or large front calender rolls are set so that the proper pressure is brought to bear on the cotton sliver being passed between them. It may be just as well to say

A FEW THINGS

here about the drawing frame which apply not only to the class of cloth under description, but also to all cotton yarns for all classes of work. Too little attention is given to the drawing frame. Just because it is one of the most simply constructed machines used in the card room, it generally

receives the least attention. This should not be the case, however, because the drawing frame, unless properly looked after, will make a great deal of difference to the appearance of the yarn made. If the drawing frame is properly looked after it will be found that the roving being made will be a great deal evener than if the drawing frames are left to look after themselves. Particular attention should always be given to the

DIFFERENT STOP MOTIONS

to see that they are doing what is required of them. It will be seen that if only one stop motion in a head does not work properly and allows an end to pass through the machine without stopping it, the resulting finished yarn is going to be lighter at that certain part and in this way make an uneven yarn. I know that it will be said that the drafts and doublings at the future machines

WILL HELP TO OVERCOME

this defect, but if the adjustment were made at the drawing frame this particular defect would not exist. Perhaps a good thing for card room overseers to paste in their hats would be, "Watch your drawing frames, first, last and always." We have wandered somewhat from the subject under description and will conclude the carding end of it by saying that no special points, outside of the ones generally followed, need be given to the making of the roving. A great deal of the unevenness of the yarn, if any exists, is covered up because the cloth is napped.

Dyeing Particulars.

The colors in the fabric illustrated can be dyed in the yarn or raw stock. The dyeing particulars are as follows:

GRAY.

For 100 pounds of raw stock for dark gray, Cassella Color Company.

1st bath: 15 pounds immedial black N. G.; 4 ounces immedial yellow D.; 10 pounds sodium sulphide; 7 pounds soda ash; 12 pounds cryst. Glauber's salt.

2d and standing bath: 7 pounds immedial black N. G.; 1 ounce immedial yellow D.; 5 pounds sodium sulphide; 3 pounds soda ash; 4 pounds cryst. Glauber's salt.

Enter stock, raw cotton, at the boil, and keep at 200 degrees F. for one hour.

Wash well with water and squeeze through rollers, and repeat operation of washing several times, until cotton is perfectly clean.

FOR LIGHT GRAY.

1st bath: 8 pounds immedial black N. G., Cassella Color Company; 3 ounces immedial yellow D., Cassella Color Company; 8 pounds sodium sulphide; 6 pounds soda ash; 10 pounds cryst. Glauber's salt.

2d and standing bath: 5 pounds immedial black N. G.; 2 ounces immedial yellow D.; 5 pounds sodium sulphide; 4 pounds soda ash; 5 pounds cryst. Glauber's salt.

Enter stock at boil, and keep at 200 degrees F. for one hour.

Wash well, as with darker shade. The immedial colors of the Cassella Color Company are absolutely fast to washing and sunlight, and are free from sulphur, so that there is not the danger of tendering the fibre as with so many of the sulphur colors.

The immedial colors are gradually replacing the direct one-dip colors which have had so long a run, and which were used so extensively for the last 10 years or more.

The immedial colors are now made into blacks, blues, browns, yellows, greens, wines and very soon there will be a full range of shades made, to match all colors required in cotton goods. The immedial blues are as fast as the indigo shades so long used for all fast colors.

PINK.

For 100 pounds raw stock, cotton: 20 pounds Glauber's salt; 2 pounds sal soda; 5 ounces diamine rose G. D.

Enter at boil and boil one hour. Wash well in water.

BLUE.

For 100 pounds raw stock, cotton: 20 pounds Glauber's salt; 2 pounds sal soda; 1½ pounds diamine blue B. X.

Enter at boil and boil one hour. Wash well in water. The diamine rose G. D. and the diamine blue B. X. are from the Cassella Color Company and are very level dyeing colors and very fast to light and washing.

A variety of colors, of course, can be used in the dyeing of this fabric.

ZEPHYR GINGHAM

Zephyr gingham is the finest grade of gingham made, and is a light-weight cotton fabric, composed of 1-40s to 1-60s cotton warp and filling yarns.

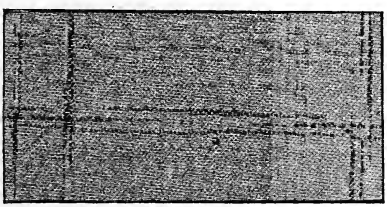
It is woven with either the plain weave or a small all-over dobby effect. It is made in very attractive patterns by using good fast colors in warp and filling, and, as a cloth, has splendid wearing qualities.

From

TWO TO TEN COLORS

can be used in both warp and filling, the filling colors being governed by the number of shuttles the loom will run, and this number is increased by the introduction of fancy colored, printed yarns.

Zephyr gingham is made up into

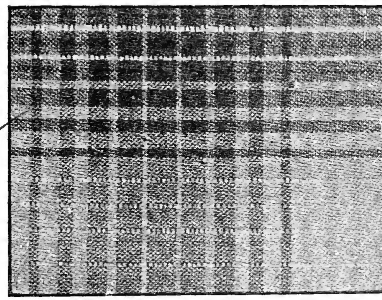


Zephyr Gingham.

such patterns as light and dark tone, shaded plaids, corded and ribbed stripes, small checks and broad, delicately colored plaids, having a random printed yarn coloring, and this last combination is woven on a dobby loom, using as a design a small broken twill arrangement. The effect produced is something on the order of a jacquard pattern.

MIXED COLOR EFFECTS

are made by dressing the warp, one end white, one end fancy print, for, say, 100 ends, and then making a rib by using a satin weave for eight or ten ends of a dark color, such as black, blue or red brown. This style is made in stripes, as stated above, also in plaids by using all white filling to cross the one and one dressing



Zephyr Gingham.

in the warp and a correspondingly dark colored filling squared with the satin rib in the warp.

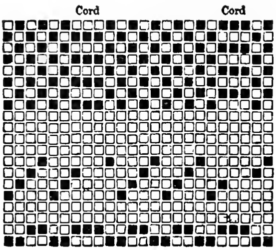
CORDED EFFECTS

are produced by drawing in 2, 3, 4 ends in one heddle and split, and this is squared in the filling by using a correspondingly heavy thread, as, for instance, 3 ends 1-40s warp in one heddle and 1 pick of 3-40s in filling. This would require such a loom as the Knowles 4x4 box dobby loom.

For a roller loom, using plain weave, and making a cord, draw warp in, as stated above, or make two cords side by side by drawing in two ends per heddle and four ends in split, and square this by two picks, each of 1-20s cotton filling.

Zephyr gingham can be woven on any roller loom. Of this style loom the 4x1 box is the more suitable. For more elaborate filling patterns there is the Crompton 6x1 box gingham loom, and for fancy weave effect take a loom having a spring bottom dobby motion attached.

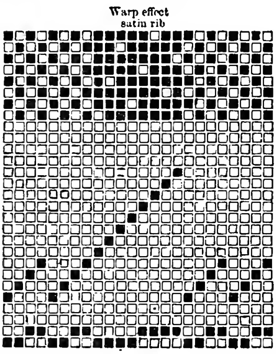
Automatic looms are beginning to be installed for the production of fancy zephyr ginghams. In instances it is claimed that as many as six colors are being woven on an automatic loom, and giving much more



Design.

Drawing-in-draft.

Reed plan.

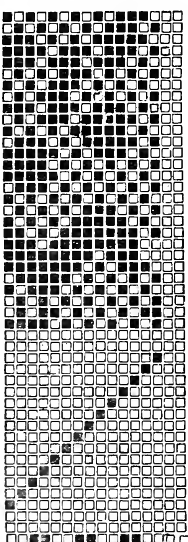


Design.

Drawing-in-draft.

Reed plan.

Fancy Dobby Weave Zephyr.



Design.

Harness chain exactly like design.

Drawing-in-draft.

Reed plan.

satisfactory results than were previously obtained. In order to use automatic looms successfully, a great deal more attention must be given to the yarns which are used in the various cloths. Certain mills have had to purchase longer cotton and install more up-to-date preparatory machinery when they installed automatic looms for the production of staple fabrics, and while this same condition does not apply to so great an extent on ginghams, nevertheless it is one of the important items.

COLORS FOR ZEPHYR.

Black, light blue, dark blue, light brown, pink, red, tan, ecru, canary, orange, new blue, old gold. Print yarns can be obtained of almost any color desired.

A good grade of zephyr gingham is made as follows:

Reed 1500, two ends per split, 29 inches wide, 80 picks; weight, two ounces about; 1-50s cotton warp and filling; finish 27 inches.

COLOR EFFECT.

Warp pattern.

4 Brown.
4 Blue.
8 Brown.
6 Blue.
6 Brown.
8 Blue.
4 Brown.
8 Blue.
1 White cord equals 3 ends.
8 Blue.
2 White.
1 White cord equals 3 ends.
2 White.
4 Blue.
4 White.
1 White cord equals 3 ends.
4 White.
2 Blue.
8 White.
1 White cord equals 3 ends.
8 White.
2 Blue.
4 White.
1 White cord equals 3 ends.
4 White.
4 Blue.
2 White.
1 White cord equals 3 ends.
2 White.
8 Blue.
1 White cord equals 3 ends.
8 Blue.
4 Brown.
8 Blue.

SHADED PLAID.
Filling same as warp pattern.
Pattern continued.

6 Brown.
6 Blue.
8 Brown.
4 Blue.
4 Brown.
2 Black.
4 Brown.
1 White cord equals 3 ends.
4 Brown.
4 Black.
4 Brown.
1 White cord equals 3 ends.
4 Brown.
2 Black.

The finish consists of sprinkling and of running cloth through very thin sizing, after which it is tentered and calendered.

Carding Particulars.

Various grades of cotton as well as different lengths of staple are used for the class of goods described. The length of staple used for the former goods is about 1 3-8 inches and generally American cotton is used. The mixings should be as large as possible so as to obtain an even yarn. It will be at once seen that if small mixings are used there will be some little difference in each mixing and just this little difference will show up in the finished yarn. This applies not only to this mixing for the class of goods described but to all mixings for all goods, and

THE MIXING

of cotton is one of the most particular points of carding, because if different lengths of staple are allowed to be mixed together, it is bound to cause trouble in addition to uneven yarn. Every bale of cotton should be separately stapled before it is allowed to be put into the mixing, and if the staple is longer or shorter than the cotton already mixed, it should be put one side.

The cotton should be run through openers and two processes of pickers, although a great many mills use three processes; but all the newer plants being built have only two processes of pickers. The

SPEED OF THE BEATER

should be about 1,050 revolutions per minute for the opener and 1,500 revolutions per minute for the breaker and 1,450 revolutions per minute for the finisher, a 12 to 13 ounce lap being made at the finisher picker.

The card should have closer settings than for the cloth described previously. Special attention should be given to the setting of the back plate to the licker-in. If this plate is set too close the cotton will be broken and if set too far away will cause bunches to come through. It is always just as well, when setting a card for new length of stock or changing over, to sample the cotton, both before it enters the card and after it leaves it, to compare the two staples and to see if they are of the same length. A good weight per yard for sliver at the card for this class of goods is 50 grains. On the former grades of the goods under description

THE COTTON IS COMBED.

This, of course, means extra expense because of the extra machines used, but it also makes the yarn evener because at the comber all the short fibers are taken out, leaving all the fibres of the same length. When combers are used only two processes of drawing are regarded, but when the combers are not used for this class of goods then three processes of drawing are used. For this class of goods only 15 per cent waste should be taken out at the comber.

At the speeders or fly frames the drawing sliver is put through the slubber, 1st intermediate, 2d intermediate and fine frames, the finished hank roving ranging from 8 to 12 hank. In the samples under description the hank used would be about 12. Watch the settings of the rolls at the fly frames and see that all your frames are set alike. These settings should be looked after all the time and should lapping or bunching occur it is a pretty good indication that something is wrong with your roll settings. If many frames are being run on the same stock,

IT IS VERY IMPORTANT

to have all the change gears the same, especially the draft gear. It sometimes happens that the wrong draft

gear will be put on one frame and the result is that the yarn is delivered to the ring spinning room or mule room uneven. It will also cause a great deal of trouble in sizing the yarns. This trouble is greater if the wrong gear is put on one of the 2d intermediate frames because the draft gear on these machines is seldom changed and you might not look here for the trouble for a long time and until considerable annoyance had been caused.

Dyeing Particulars.

The colors in the fabric illustrated are dyed in the yarn. The dyeing particulars are as follows:

LIGHT TAN.

For 100 pounds yarn: 12 ounces immedial yellow D., pat.; 2 ounces immedial olive B., pat.; 7 ounces immedial cutch G., pat.; 5 pounds sodium sulphide; 10 pounds cryst. Glauber's salt; 3 pounds soda ash. Enter yarn at boil and boil one hour. Wash well with two or three waters.

ECRU.

For 100 pounds yarn: 6 ounces immedial yellow D, pat.; 1 ounce immedial olive B., pat.; 4 ounces immedial cutch G., pat.; 5 pounds sodium sulphide; 10 pounds cryst. Glauber's salt; 3 pounds soda ash. Enter yarn at boil. Boil one hour. Wash well with two or three clean waters.

LIGHT BROWN.

For 100 pounds yarn: 8 ounces immedial brown B., pat.; 1 pound, 4 ounces immedial cutch O., pat.; 5 pounds sodium sulphide; 10 pounds cryst. Glauber's salt; 3 pounds soda ash. Enter yarn at boil, and boil one hour. Wash well with two or three waters.

OLD GOLD.

For 100 pounds yarn: 2 per cent immedial yellow D, pat.; 6 per cent sodium sulphide; 12 per cent cryst. Glauber's salt; 3 per cent soda ash. Enter yarn at boil. Boil one hour. Wash well with two or three waters.

PINK.

For 100 pounds yarn: 6 ounces diamine rose G D, pat.; 2 pounds sal soda; 25 pounds Glauber's salt. Enter at boil. Boil one hour. Wash well in water.

NEW BLUE.

For 100 pounds yarn: 3 per cent immedial sky blue powdered conc.; 5 per cent sodium sulphide; 10 per cent cryst. Glauber's salt; 3 per cent soda ash.

After treated with ½ per cent bichrome potash; ½ per cent bluestone. Wash well with water.

LIGHT BLUE.

For 100 pounds yarn: 1½ per cent immedial indone B, pat.; 1½ per cent immedial sky blue powered conc.; 5 pounds sodium sulphide; 10 pounds cryst. Glauber's salt; 3 pounds soda ash. Enter at boil. Boil one hour. Wash well with water.

DARK BLUE.

For 100 pounds yarn: 5 pounds immedial indone blue, 3 B, pat.; 10 pounds sodium sulphide; 15 pounds cryst. Glauber's salt; 5 pounds soda ash. Enter at boil. Boil one hour. Wash well with water.

ORANGE.

For 100 pounds yarn: 5 pounds immedial orange C, pat.; 8 pounds sodium sulphide; 15 pounds cryst. Glauber's salt; 5 pounds soda ash. Enter at boil. Boil one hour. Wash well in two or three waters.

BLACK.

For 100 pounds yarn, 1st bath: 20 pounds immedial black NN. conc.; 12 pounds sodium sulphide; 20 pounds cryst. Glauber's salt; 5 pounds soda ash.

2d bath: 10 pounds immedial black N N conc.; 8 pounds sodium sulphide; 15 pounds cryst. Glauber's salt; 4 pounds soda ash.

Enter at boil. Boil one hour. Wash well in two or three clean waters.

The Finishing.

In the finishing process use: 4 to 8 ounces cornstarch, 4 to 8 ounces cocoanut oil, white softening, 1 gallon water. Mix cold, boil half an hour. Starch through mangle. Run over drying cylinders. Sprinkle, and cal-

ender through light calender. After starching, the goods are sometimes dried over the tenter frame to keep the pattern straight across the piece.

CRINOLINE

Crinoline is a fabric composed of cotton warp, horsehair filling or all cotton yarns. It is sold in varying widths, and is used by tailors and dressmakers in stiffening clothing.

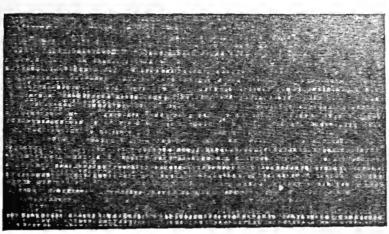
It is a cheap cloth of low texture and simple construction,

THE DISTINGUISHING FEATURE

being the stiff finish with either a dull or highly glazed face on the cloth. Crinoline, having a horsehair filling, requires a loom of special construction to handle the hair, as it is hung in a neat bundle on the end of the loom, the hair being of a uniform length and color, generally black; the mechanism on the loom drawing a strand of hair from the bunch and placing it in the shed formed by the harness. A herring-bone twill weave is used in this grade of the cloth. Practically

THE SAME EFFECT

can be produced by using a glazed warp thread and a cotton filling. The glazing process is to take the cotton warp thread, and after charging heavily with a solution of sizing, the yarns are run through super-heated cylinders and rollers, the



Crinoline.

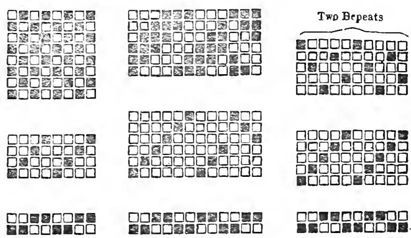
effect being a highly polished surface to the yarn.

Crinoline composed of regular cotton yarns is stiffened by weighting the fabric with sizing; the weight of the size, in some cases, equals 20 per cent of that of the yarns used in construction.

Crinoline is made generally on the roller or cam loom of 1-20s to 1-26s cotton warp and filling yarn, using 25 to 40 ends and picks per inch, the cloth losing about 10 per cent of its width from loom to finished width. The warps are sized 6 to 10 per cent and the woven cloth made to absorb 15 to 20 per cent of its weight, during sizing operation.

TO FINISH CRINOLINE

means to stiffen it. The cloth is therefore taken direct from the loom to the size tubs and after this opera-



No. 1. No. 2. No. 3.

1. Crinoline. Plain weave.
2. Crinoline. Herring-bone Weave.
3. Haircloth; 5 harness satin filling effect.

tion it is run through the cylinders to dry it, after which the glaze finish is produced by the action of the heated rollers in the calender machine. The cloth is then rolled or lapped, to whatever size bolt desired, the bolt pressed in plate press, and the crinoline is ready for the packing cases.

Crinoline is usually made in either solid black or cotton in the gray; plain weave; reed 700; 1 end per split; 27½ inches reed; 1-26s cotton warp and filling; 36 picks; 20 per cent size in finish.

Color, black; weight, 1.9 ounces; 16 square inches, weight 15.1 grains, finished weight; 16 square inches, weight 12.1 grains after sizing is removed.

Horsehair is used in manufacturing haircloth, a fabric used for furniture covering, the weave being a

filling effect satin (generally about five harness) to throw hair on the face of the cloth. These satin weaves permit of about 15 per cent more ends and picks than are used in an ordinary weave. This is due to the long floats in either warp or filling effect satins.

Carding and Spinning Particulars.

Although the yarns used to make crinoline are what are called coarse yarns it must not be thought that they may be neglected in any way in the carding and spinning, because coarse yarns should not be thrown together any more than the finer counts of yarns. We should not turn our attention from the carding and spinning of coarse yarns and let them be run through the different machines until the required count is made, but we should give special attention to the production end of these yarns, as it is here we can make the best showing. In coarse counts of yarns it should be our aim to get as large a production from each machine as possible and

NOT OVERLOAD THE MACHINE,

and at the same time produce as good a finished yarn as possible. Another thing, when making coarse counts of yarn we are not required to take out as large a percentage of waste as when we are making the firmer counts, and while enough waste should be taken out so that the yarn will not be bunchy, still it will be at once seen that the settings will not be as "close" as when the firmer counts of yarn are being made.

A low-grade, short-staple class of cotton is generally used for making the class of goods under description. Sometimes this is used straight but some mills use waste from the comber in the mixing as well as the low-grade cotton. Generally

TWO PROCESSES

of picking and opening are used, the speed of the beater being around 1,500 revolutions per minute, the beats per inch being between 42 and 45. The beater is run at a higher speed on short-staple cotton for two reasons: First, because it is necessary to run it at a higher rate of speed in order to get all the dirt out; and second, because it can be run at a higher speed because there is not so much liability of making neps, for the reason that the staple is short and does not ball up as easily as the long-staple cottons.

The weight of the whole lap at the finisher picker is about 40 pounds, or about 14½ ounces to the yard in length.

THE CARDS

are set so that the tops are about 12-1,000 of an inch away from the cylinder wire (coarse wire being used on both cylinder and doffer fillets). The licker-in knives are set as close as possible without touching, so that they may throw out as much dirt as possible. The draft of this machine should be about 100, the production from 750 to 1,000 pounds for this class of goods and the weight of sliver per yard at the front about 65 grains per yard. The ones in charge of the cards should see that the cards are properly ground because when running large productions of low-grade cotton the wire on the fillet becomes dull and does not perform its duty.

TWO PROCESSES OF DRAWING

are used, generally 6 ends up. As the weight per yard of sliver is heavy at the drawing frame for this class of goods, a point to look out for is to see that the weights attached to the top rolls are sufficient to hold them down so that they will not jump. The weight of the sliver at the point of the finisher drawing should be about 75 grains and the speed of the front roll about 400 revolutions per minute; the hank roving at the slubbers about .40; at the first intermediate fiy frame 1.40 and at the second intermediate 3.75 to 4.25 hank. From the second intermediate frame the roving goes to the spinning frame, where it is spun into the required yarn, or from 20s to 26s, being used for this class of goods, i.e., crinolines.

Dyeing Particulars.

Crinoline linings are generally dyed with a cheap logwood black.

Make up a solution of logwood extract at 6 degrees Tw. Add common wood acid, 6 degrees Tw., 1 pint acid, 1 gallon logwood, 6 degrees Tw. Run through two-box machine, pieces running into liquor 8 to 10 times, and through nip of two rubber rollers, liquor at the boil. Dry on cylinder drying machine, and run through chrome bath of ½ pound bichromate soda to 1 gallon water, and run through a steaming box to develop the color. Wash well in water. Starch, ½ pound dextrin, 1 gallon water. Boil the starch up for one hour before starching. Dry on cylinders or on tenter frames, as required. Some crinoline linings are calendered in friction calender, and afterwards embossed on embossing machine with a slash pattern.

Some crinoline linings are starched by hand in the tub, and stretched on a stenter frame and dried on the frame.

DAMASK FABRICS

The name damask is technically applied to certain classes of fabrics, richly decorated with figures of foliage, fruits, scrolls and other ornamental patterns, usually of a large and elaborate character.

The weaves usually employed are twills (mostly satin) and the figures in the fabric are made by alternately exchanging warp for weft surface or vice versa.

The materials employed vary according to the purpose to which the fabrics are to be applied. In the manufacture of upholstery cloth for hangings and furniture covering, silk or worsted is used, while for table covers, towels, napkins, etc., linen is generally employed, except in the cheapest grades, when cotton is the material used.

The name was derived from the city of Damascus, when that city was a center for the production of textile fabrics, and originally was applied only to silken fabrics, whose designs were very elaborately woven in colors and often with gold thread.

About the twelfth century the abovementioned city, even then long celebrated for the production of its looms, so far outstripped all other places for beauty of design, that her silken textiles were in demand everywhere, and thus, as often happens, traders fastened the name of Damascen or Damask upon every silken fabric richly wrought and curiously designed, no matter whether it came or not from Damascus.

In order to explain the modus operandi for the production of damask in this country, suppose we place ourselves in the position of a public designer, whose specialty is the designing of patterns for such fabrics.

THE SKETCH.

The first step in the operation is to prepare a dozen or more sketches, which are to be shown to manufacturers to take their choice. A specimen of such is illustrated by Fig. 1 (reduced), the original of which is drawn on ordinary tracing paper, the exact size, as it will appear in the cloth.

This design or sketch is to be made into a damask table cover, having 50 threads warp and 44 picks weft per inch, the figure of which is to be a 5-leaf 4—1 satin twill (warp face) and the ground a 5-leaf 1—4 satin twill (weft face).

PROPER DESIGN PAPER.

The next step to be taken is to select the proper designing paper, the size of which, that is, the number of rectangles, warp and weft, in each large square, must be in the exact proportion to the number of threads (warp) and picks (weft) in one inch of the finished cloth. The mode of figuring is after the following manner:

Paper for warp ruled eight rectangles per large square; paper for weft ruled in the same ratio to eight as 44 is to 50.

Operation: x : 8 : : 44 : 50; therefore 44x8 equals 352 divided by 50 equals 7.04, answer, 7.04 is near

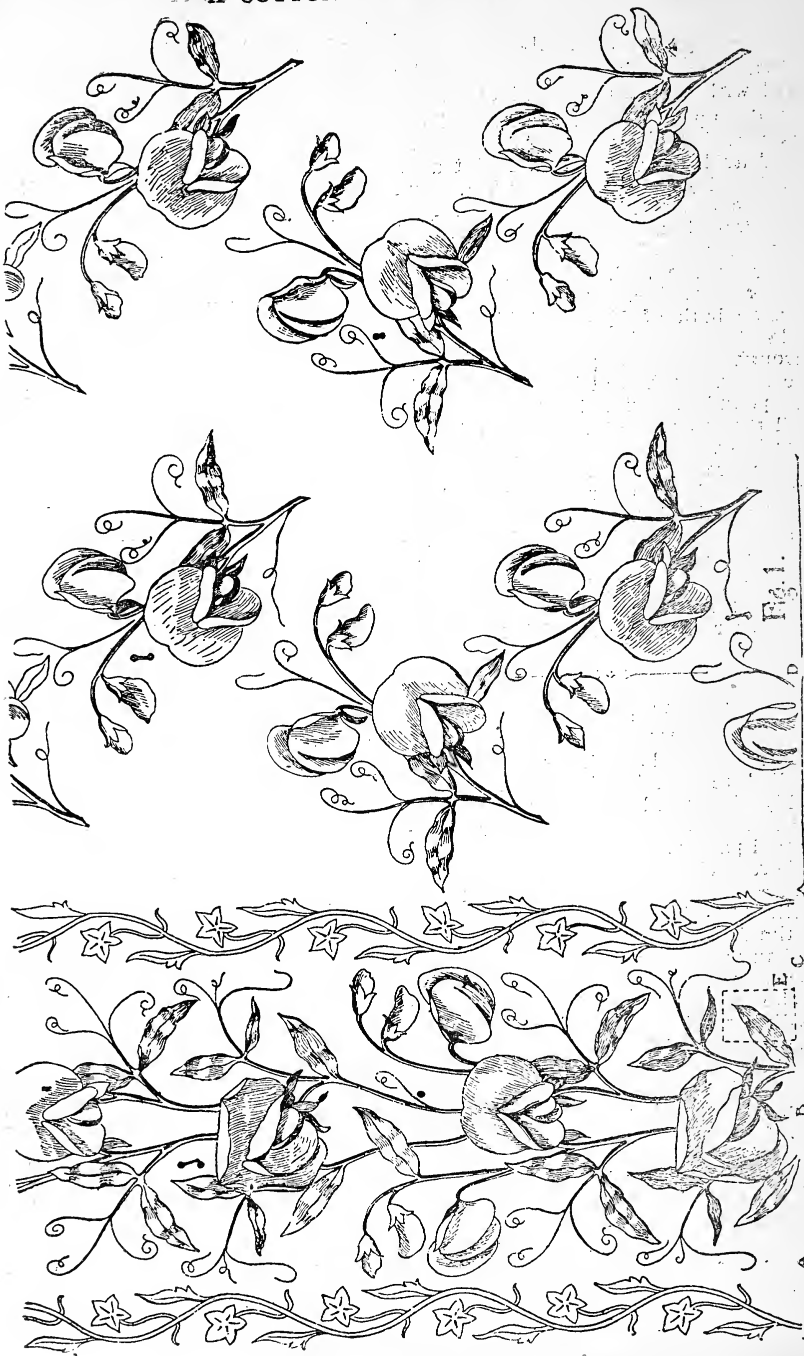


Fig. 1.

enough to call it 7; therefore, 8x7 is the proper size of design paper required.

TIE-UP.

Then the tie-up must be considered, which in the present instance will be a 600-hook, with the tie-up as illustrated by Fig. 2 French system—point for border, and straight through for body, in six divisions.

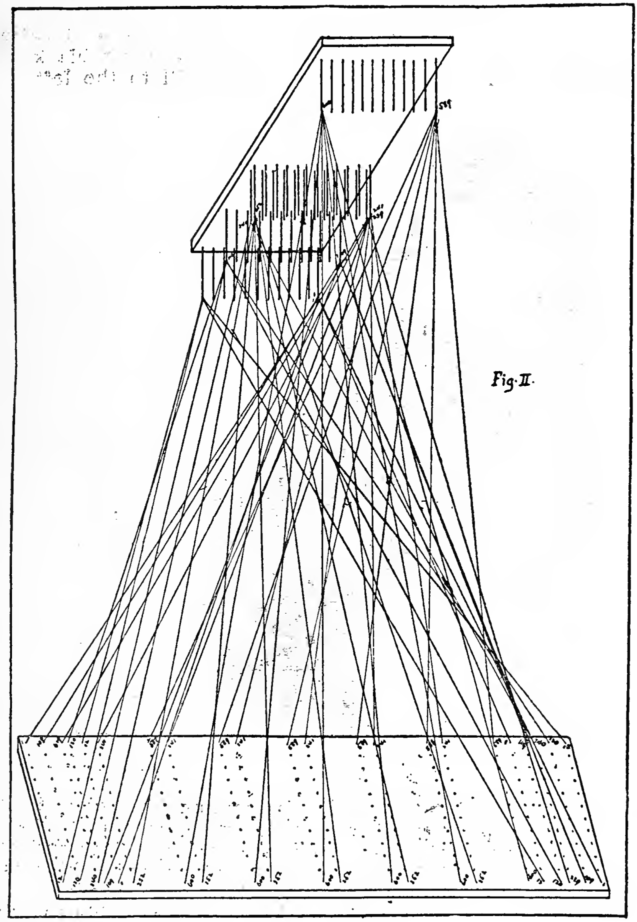


Fig. II.

The next process is to enlarge the design as it appears in the sketch, so that one repeat will exactly fit on 600 rectangles (warp) of the designing paper selected.

That portion of the border shown at A, in conformity with the tie-up, should occupy the first 15 squares or 120 rectangles; that shown at B the next 15 squares or 120 rectangles; that portion shown at C is not required on the design paper, because it is a repetition of that part shown at A, but simply reversed.

For the body of the design shown at D, 45 squares or 360 rectangles will

be required, which will complete the 600 hooks of the machine. Summing them up they will be as follows:

Portion A=15 sq.×8=120 rectangles } Border.
Portion B=15 sq.×8=120 rectangles }
Portion D=45 sq.×8=360 rectangles } Body.
600 rectangles

In order to ascertain how many squares or rectangles the design will occupy weft-wise the sketch must be measured, which in this case happens to be seven inches. Therefore, 44 picks per inch times 7 inches equals 308 rectangles; but as 5, the number of threads in one repeat of weave (satin), will not divide into 308 evenly, 310 must be taken (310 divided by 5 equals 62). Therefore, the design will occupy 600 rectangles (warp) times 310 rectangles (weft).

PAINTING IN THE DESIGN.

After the design is transferred to the design paper, the next process is to paint in the weave, in the following manner, or as shown by a portion of the design, taken from sketch at E, and illustrated by Fig. 3.

1. Paint in the figure in solid red (vermilion or scarlet lake), keeping well within the lines.

2. Paint in the 1—4 satin twill in the ground, running the twill toward the right.

3. Paint in the 4—1 satin twill in the figure by using black paint over the red. Twill to the left.

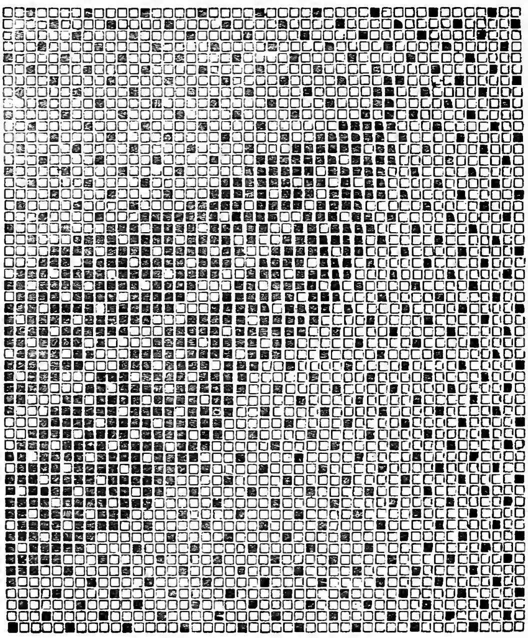


Fig. 3.

In joining the ground and figure twills great care must be exercised so as to effect a clear outline between figure and ground, which is done by the following method:

Where it is possible to bring a riser (black) of the ground beside a sinker (white) in the figure weave or vice versa, it must be done and in some cases, where the risers and sinkers will not join, it is well to alter the weaves slightly so as to effect it; and where it is impossible to do this, then

the weaves of each must not be extended so as to actually join, but a certain length of weft in the ground must join a certain length of warp in the figure. (See portion of design, Fig. 3.)

When painting in the satin twill of the ground in the border of the design it is necessary that the twill should extend to the right for one-half the distance and to the left for the remainder, therefore, as this breaking of the twill line causes a slight imperfection, which is unavoidable, care must be used so as to make the break in such portion of the border as will render it unnoticeable.

Again it is necessary also to be careful so as to make the weave of the border join perfectly with that of the body; and this is done by carefully examining the tie-up so as to ascertain which warp threads will join each other in the cloth and take steps to make a perfect juncture.

In this particular instance, warp thread No. 1, which is the first of the border, is in juxtaposition with warp thread No. 241, which is the first of the body. (See Tie-up, Fig. 2) Therefore, the satin twill of the body, commencing with warp thread No. 241, should continue, without a break, the satin twill of the border finished at warp thread No. 1.

WEAVES TO USE.

Although in the majority of damask fabrics nothing but satin twill weaves are employed (principally 5 and 8 harness), very good effects are sometimes obtained by combining other weaves with the satin twills. For instance, one side of a leaf may be painted in with a satin twill weave, and the other side may be a straight twill, thus giving the leaf a shaded effect, which may be very pleasing.

Another method of shading and the one generally employed is to gradually change from warp-up to weft-up or vice versa, as illustrated by Fig. 4.

In damask there is probably a greater field for the production of large figures than in any other class of weaving. There are two methods of weaving damask. First, by the use of the ordinary jacquard, which is discussed in the present article, and second, by the use of what is called the compound pressure harness.

By the first method, although very elaborate figures can be woven and a fine cloth produced, yet by the second method a command is obtained over four or five times as many warp threads as by the first, thus allowing the production of a fabric of much finer texture and even more elaborate ornamentation.

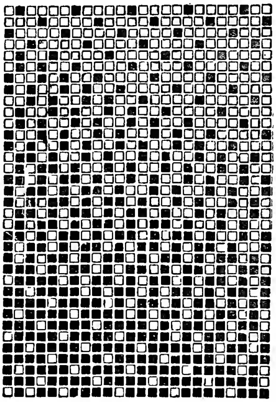


Fig. 4.

A description of damask weaving by the use of the compound pressure harness will be given later.

Where damasks are made all of one color, which is generally the case, as in white linen table covers, the effect is given by the threads lying at right angles to each other, and the light falling upon them brings the pattern in bold relief and makes it easily visible.

FINISHING OF CLOTH.

As it is impossible in the scope of the present article to describe the bleaching, dyeing and finishing of all the various damask fabrics, we can at least say this—that in the case of the linen table covers, towels, etc., all the finishing required is bleaching, starching and pressing.

But as the beauty of the fabric largely depends upon its whiteness, it is essential that the bleaching of the cloth must be very carefully done.

It is on account of the excellence of her bleacheries that Ireland has been able to make Irish linen famous the world over.

Carding and Spinning Particulars.

Cotton damask is made in several grades and should be considered as being made in mills equipped with machinery for making medium and high-class goods. The grades of cotton used for this class of cloth are middling to good middling, the staple varying from 1 1-16 to 1⅜ inches strong, according to the grade of damask to be made.

THE MIXING

should be as large as possible and, if good waste is used, i. e., sliver waste from the front of the cards, and drawings, also sliver waste from sliver lap machines and combers, and cut roving waste from the slubber and fly frames, it should not be used in larger proportions than 1 to 3. In up-to-date mills, and in fact most mills nowadays, it is the general custom to have a waste machine into which the cut waste from the slubber and fly frames is picked. This is called

A WASTE MACHINE.

This machine is constructed so as to take out all the twist in the roving and generally has for this purpose two or three porcupine beaters, and the cut roving waste is delivered in a fluffy sheet, from which all the twist has been taken. The good sliver waste from the machines above mentioned is mixed with the raw stock, while the cut roving waste, after being run through the waste machine, is fed to a picker and made into a lap of the same weight as the lap being used at the finisher picker, for this class of goods, and then the waste lap is run through with the raw stock lap at the finisher picker in the proportion of three laps of raw stock to one of cut waste, the cut waste being generally put so that it will come in the center of the delivered lap.

The cotton, after being mixed, is put through a hopper opener and either two or three processes of pickers, two processes being best, the speed of beater being 1,050 revolutions per minute for openers, 1,500 for breakers and 1,450 for finishers, also 1,450 revolutions per minute for intermediate pickers, when used. This gives about 42 beats per inch at the finisher. The weight of laps should be 40 pounds at breaker, 37 pounds at intermediate and 36 pounds at finisher.

THE CARDS

should be set close, the speed of the flats making incomplete revolutions every 50 minutes. The draft of the card for this class of goods is about 110 to 125, doffer 24 inches, about 13 revolutions per minute, 26-inch doffer, about 12, the production being about 500 pounds per week. In the drawing frames the rolls should be set ⅛ of an inch longer than the staple between the first and second rolls, and increase ⅛ of an inch between each set of rolls toward the back. The speed of the front roll should be about 400 revolutions per minute.

The general instruction given in a previous lesson on ginghams may be followed, except in the case of the hook roving.

IN THE FINER GRADES

of damask the comber is used and then only two processes of drawings are used instead of three, as is the custom when combers are not used.

Earlier in the lesson we have stated that cut-roving waste was used in the mixing. Cut roving results from badly made bobbins; bobbins not being marked, it being better to cut the roving off of these bobbins rather than to run the risk of getting them mixed up with other hanks of roving; bobbins on which there is a large amount of single or double, which is generally not allowed, but which will be made in spite of the most careful watching; bad bobbins resulting from breakdowns to machinery, and bobbins which are too small to send to the spinning or mule rooms. It is best to have only one hand to cut off these so-called bad bobbins

In larger mills one hand is employed to do this, but it is the general rule to have the third hands on fly frames do it. Under no consideration should the help (fly frame hands) be allowed to cut off the bad work which they make.

The cut roving should be sorted into piles of different lengths of staple, also into different piles, as to kinds; for example, Egyptian should not be put with Allan, even if of the same grade and length of staple.

WHEN CUTTING OFF ROVING

the hand should be careful not to cut the bobbin, because this in time will make the layers nearest to the bobbin stick to the wood, when they are again used. The bobbins containing a small amount of single and double should be pulled off by the hand making them, who may be found by the marks on the bobbin, if she allows the bobbin to go to the spinning or mule room. The hand gathering the roving waste should be careful not to mix the different staples and kinds, and it should be taken to the picker room and placed in the different bins provided for roving waste, which bins

SHOULD BE PLAINLY MARKED

as to staple and kind. The one collecting the waste should report all cut waste found, and also those making an excessive amount of waste, to overseer. The overseer should keep an account of this roving waste, as well as the good waste, so that he may at all times know just how much is made. In this way he is always in touch with the waste made in different departments and always knows whether too much waste is being made. The boss picker is the best man to weigh all wastes, because it is to his department that the kick is made on account of bad laps. Reports are generally sent in once a week with the amount of waste for each day.

Damask Cloth Bleaching.

First, boil with 4 degrees Tw. caustic potash for 8 to 10 hours. Run through washing machine and place in kier for second boil, with 4 degrees Tw. caustic potash. Boil 8 to 10 hours. The kier is the ordinary bleaching kier. After second boil, run through washing machine. Pass through solution of bleaching powder at ½ degree Tw. and plait down in bin for four hours. Pass through sulphuric acid ½ degree Tw. and wash well with washing machine, until all trace of acid is eliminated.

Starching: 8 to 10 ounces cornstarch; two ounces white cocoanut oil softening; one gallon water. Pass through starch mangle and dry on cylinder drying machine.

Damp pieces and give a calender finish.

ANOTHER HAMMOCK CLOTH

Hammock cloth is a fabric composed of either jute, cotton, silk, silkaline or linen, and is intended for just such use as the name implies, that of a swinging couch or hammock. The all-cotton hammock is the most popular, and finds the readiest market. Hammocks composed of other material than all cotton are the exception, not the rule. The

TWO MOST IMPORTANT FACTORS

to be considered in the construction of this fabric are: strength, and a pleasing color arrangement or combination, good yarns being used to provide the proper amount of elasticity of fabric, therefore strength.

Hammock cloth, when manufactured into that commodity known as hammocks, is more of a luxury than an actual necessity, being used only for outdoor purposes in warm weather. Hence the importance of attractive

COLORING.

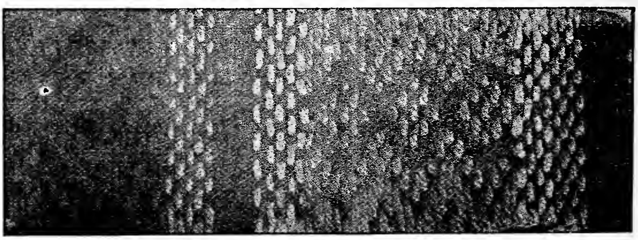
Dry colors are used in cheap grades such as retail at about 75 cents. Fast colors are used in expensive grades, the price of which is from $1.50 upward. In all cases bright, rich, lively shades of color are necessary. Those colors most commonly used are red, blue, purple, pearl, black, white, green, as well as others in both light and dark shades.

Hammock cloth is most successfully woven on the dobby loom, the very cheap grades being made with a

SCRIM WEAVE

and from 6 to 8 ends and picks per inch, $\frac{3}{8}$ cotton yarn. By using the dobby loom very rapid changes are possible, by altering the drawing-in draft wherever necessary. This is important in sampling and is rather expensive when applied to the jacquard loom.

In creating hammock styles, very elaborate imitation jacquard figures are produced by taking a design suit-



Hammock Cloth.

able for a dobby loom of about 20 harness, generally twill effects; and by dissecting the design and applying the parts (straight or reversed) to a series of broad and narrow colored stripes in the warp or warp pattern, we produce an effect both intricate and attractive. Care should be taken, however, to insert several small stripes of plain weave, as this prevents the cloth from pulling out of shape on account of the loose texture permitted by the use of twill weave.

In making a warp for a hammock, the colored and plain yarns are spooled upon six-inch spools. These are set up in the creel rack by the warper, in accordance with the pattern or color arrangement desired.

THE WARP

is made upon a section mill, each section being warped and run upon the mill the desired length; the number of sections in the completed warp is figured out by the warper, according to number of ends to be used, and the capacity of the creel rack.

To replenish a warp in the loom, if the same harnesses are to be used in the same manner as the warp just finished, the new warp is placed on the floor directly behind the loom to be filled, and the ends of both warps tied together by using a flat knot, the same as is used in tying in carpet warps. This fabric requires

ABSOLUTELY NO FINISH

and is made up into hammocks immediately after leaving the loom.

Hammock cloth is made from 34 to 44 inches in width, and always of three or more ply yarns.

A good grade of hammock cloth can be produced by using: 3-10s cotton warp and filling; 750 reed, 42 inches wide; 18 ends, 16 picks per inch; weight $8\frac{1}{4}$ ounces; measure about 38 inches from loom.

WARP PATTERN:

19	Light green	
8	White	
46	Navy blue	
4	Black	
23	Light green	Read from top to bottom, then reverse.
4	White	
15	Light blue	
4	Light green	
29	Dark green	
4	White	
64	Navy blue	
8	White	Do the same in drawing in.
64	Navy blue	
12	Black	
64	Light green	
10	Black	
378	ends.	

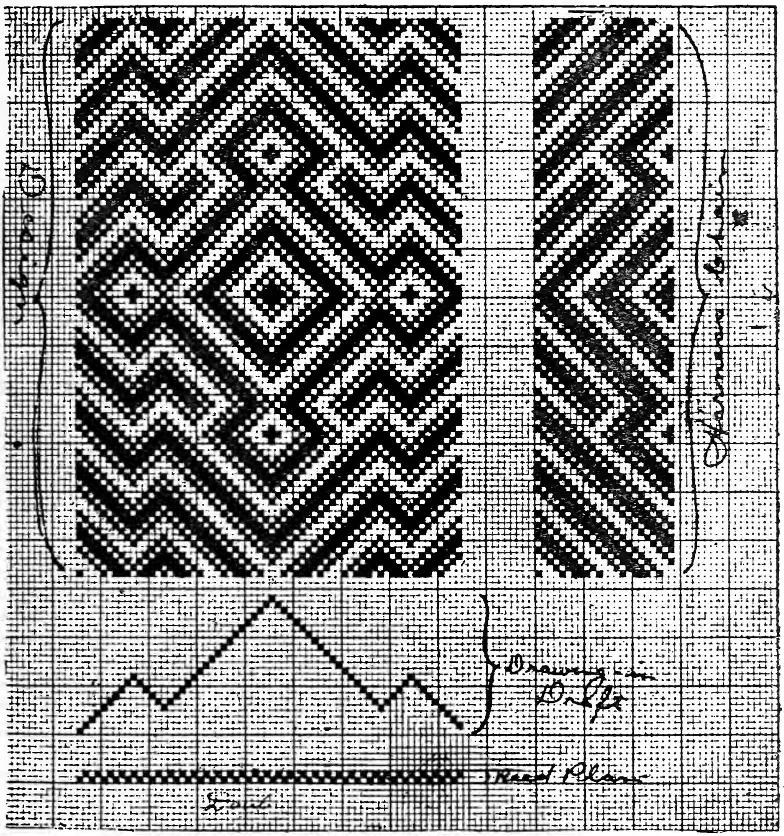
Carding and Spinning Particulars.

For this class of cloth, either a low-grade of short stapled cotton is used, or, as is more generally the custom, waste. When straight cotton is used, quantity is more to be looked out for

than quality. By this it is not meant that quality is not considered at all, but that quantity or production is

THE MOST IMPORTANT POINT

of the two for this class of goods. The quality should be the next point. Get while the production may be greater for a short length of time, the ends breaking down at the front and the time lost in piecing them up constitute only one of the items that more than makes up for the loss in pro-



all the production that is possible from every machine, but always have one thing in mind, that it is not always the greatest speed of the front roll together with the heaviest weight per yard of sheet, sliver, roving or yarn being delivered that gives the most production at the end of the week.

There is always a speed over which it is folly to drive a machine because, duction of a more slowly driven machine, which will run more steadily and make evener yarn.

ANOTHER THING

that must be taken into consideration when reading these articles is that, while we describe the different processes through which the cotton has to go to make the required finished yarn for the cloth, also the general settings

of the machines required, it would be almost impossible for one mill to make every cloth that will be described, so that it must be understood by the reader, when reading the details of the different grades and kinds of cloth, that one mill makes only several cloths of the same grade. So,

IN ORDER TO AVOID CONFUSION

in the future, let us divide the mills into three different parts, first those using waste and low-grade cotton; second, those using low and middling grades of cotton, and third, those using middling and high grades of cotton. While the differences are not so great between the first and second and the second and third as between the first and third, still the differences are there in the number of processes used and the size of rolls, also size of wire on certain machines. All that is asked of the reader is to consider which division of the mills the cloth under description belongs to and the rest will be very clear. Hammock cloth, of course, belongs to the first-named division.

For this class of goods the cotton is put through opener and picker; the speed of beater is one of the points to be looked after.

AT THE CARD

coarse wire is used on both fillets and the speed and setting of the doffer comb should be looked after to see that it is properly stripping the doffer. At the drawing frame a smaller second roll should be used, so that the rolls may be set close enough together, as the staple of the cotton being used is very short. At the slubber and fly frame this is also true. The one watchword with this class of goods is production.

Particulars for Dyeing Yarn.

LIGHT OLIVE.

One-half per cent benzo dark green GG; ¾ per cent chrysophenine; 20 per cent Glaubers; 2 per cent soda; enter at 120 degrees F., and raise to 180 degrees F., give six turns.

Benzo dark green GG, and chrysophenine are colors from Elberfeld Farbenfabriken.

VIOLET.

1¼ per cent benzo fast violet R; 20 per cent Glaubers; 2 per cent soda; enter at 120 degrees F.; give six turns to 180 degrees; color from Elberfeld Farbenfabriken.

YELLOW.

2½ per cent fast cotton yellow C, extra; 20 per cent Glaubers; 2 per cent soda; enter at 120 degrees F.; give six turns to 180 degrees F.; color from C. Bischoff and Company.

ORANGE.

2 per cent fast cotton orange 6R, Ex.; 20 per cent Glaubers; 2 per cent soda; enter at 120 degrees F.; give six turns to 180 degrees F.; color from C. Bischoff and Company.

RED.

3½ per cent benzo fast red GL; ½ per cent chrysophenine; 20 per cent Glaubers; 2 per cent soda; enter at 120 degrees F; give six turns to 180 degrees F.; color from Elberfeld Farbenfabriken.

BLACK.

5 per cent direct deep black E, extra 30 per cent Glaubers; 2 per cent soda; enter at 180 degrees F.; get up to boil, give eight turns; Farbenfabriken of Elberfeld.

PURPLE.

3½ per cent benzo fast violet R.; 30 per cent Glaubers; 2 per cent soda; enter at 150 degrees F.; and give eight turns; Elberfeld Farbenfabriken.

BLUE.

3½ per cent fast direct blue R.; 30 per cent Glaubers; 2 per cent soda; enter at 150 degrees F.; give eight turns at boil. C. Bischoff & Company.

BROWN.

3 per cent direct brown NX; 30 per cent Glaubers; 2 per cent soda; enter at 150 degrees F.; give eight turns at boil; C. Bischoff and Company. A great variety of colors are used in hammock cloths.

TERRY CLOTH OR TURKISH TOWELING.

Terry cloth or turkish toweling is a fabric composed entirely of cotton yarns. In effect it is a single cloth, having rows of loops, formed by warp yarn, in regular order, on each side of the cloth.

In making this fabric, it is necessary to use two beams. No. 1, or the bottom beam, contains the warp for making the body or ground of the cloth. No 2, the top or terry beam, contains the warp for making the loops in the cloth or terry effect. Terry cloth is used in the manufacture of towels and Turkish bath robes, and, as to color, there are solid bleached towels, towels having side and cross border color effects, also stripe patterns for the bath robes, favorite colors being navy blue, old gold, cherry red, light green, etc. The warps are of 2-20s to 2-30s cotton and the filling 1-20s to 1-30s cotton.

Terry cloth is a narrow fabric measuring about 25 inches from loom and can be made on the roller or cam loom or the dobby or jacquard loom, either style of loom, of course, having the terry motion attached; the jacquard machine being only necessary in making fancy border effects in conjunction with the filling box motion. Very good cross border patterns are produced on a mutual loom, having terry motion and dobby attached.

The terry weave is the three harness twill weave dissected, and the different parts of this weave placed together again in such a manner as to permit the forming of a series of loops on each side of the cloth in regular order, by the top or terry warp weaving slack, using only sufficient weight to permit of correct shedding.

In making terry on a roller or cam loom, four harnesses and four cams are necessary, two cams being warp effect and two cams filling effect. The top beam containing terry warp is drawn in on first and third harnesses and the bottom or ground warp on second and fourth harness, reeded two ends per split and placed in the loom, the first and third harnesses being strapped up to the first roller, the second and fourth harnesses being strapped up to the second roller. The harnesses are then connected with the treadles at the bottom of loom by means of jack straps, these treadles being in turn operated by the cams, which are set on a cam shaft.

The cams for this weave are those of a $\frac{2}{1,}$ $\frac{1}{2}$ 45 degrees twill, and are so arranged on the cam shaft as to produce the terry effect. The warps are drawn in 1, 2, 3, 4, weaving one terry, one ground end.

The cams are arranged as follows:

One $\frac{2}{1}$ Warp effect cam.
One $\frac{1}{2}$ Filling effect cam.
One $\frac{2}{1}$ Warp effect cam.
One $\frac{1}{2}$ Filling effect cam.

WEAVE.

First pick, first, fourth harness up; 2, 3, harness down. Second pick, first, second harness up; 3, 4, harness down. Third pick, first, second, harness down; 3, 4 harness up.

The terry motion is arranged thus:

At the bottom of the loom, near the side, there is a treadle, suspended in much the same manner as the cam treadles. To the treadle there is an iron (½ inch) rod attached and running up the inside of the loom and connected with an iron lever, which works upon a fulcrum, bolted to the loom side, the loom driving shaft rests in box or bearing on the side of the loom. This box is so shaped that it allows the shaft an eccentric motion, when the terry treadle is forced down by a cam, placed on the lower loom shaft for the purpose.

When the terry cam, revolving on the lower loom shaft, strikes the terry treadle, the rod connected thereto pulls down on the lever connected with the box in which is resting the driving shaft, the whole action throws the loom shaft and loom sley forward

out of line, and the top warp working slack the reed draws the yarn through; then the terry treadle regaining its original position, the loom shaft settles back to its correct posi-

Design.

Drawing-in Draft.

Reed Plan.

1st Terry. 2d Ground. 3d Terry. 4th Ground.

tion and the next pick of the loom binds in the slack warp, thus forming the loop in the cloth—the terry motion in this case working for two picks and stopping for one.

In weaving toweling on a roller loom, it being of short lengths of terry, the weaver allows the cloth to weave terry for any desired length, and to weave solid cloth without the loop, he throws the terry motion out of gear by dropping an iron finger down on the treadle. This holds the terry treadle out of the way of the revolving terry cam. This iron finger is usually either raised or lowered by means of a cord, fastened to the inner side of the breast beam and near the end of the loom.

This finger can be worked automatically by the use of a dobby motion or jacquard machine.

The terry warp, by weaving slack and forming the loops, will weave out at the rate of about 100 or more per cent faster than the ground warp. It is then replaced by twisting another warp to it, this operation taking place at the loom and without removing the harnesses.

A good grade of terry cloth can be made as follows:

Reed—900, two ends per dent, 27 inches in reed; 2-30s cotton ground warp; 2-30s cotton terry warp; 1-30s cotton filling; 36 picks. Width from loom, 25 inches.

To be drawn and woven as stated above for a roller loom.

Carding and Spinning Particulars.

Yarn to make terry cloth or Turkish toweling belongs to the second division of mills, i. e., the mills making cloth from low and middling grades of cotton (raw stock). The yarn is generally made from cotton of about 1-inch staple. The mixings should be as large as possible and good waste is generally thrown into the mixing bin at such times as it is usual to collect it from the different machines. It is usual in all mills to gather this good waste, which is really no more than the tail ends of laps, from the pickers, sliver which has not been properly coiled in the cans at the cards, combers and drawing frames, also any waste that contains the proper length of staple, which has been made at the different processes, which from improper care or handling or some defect in machinery cannot be used at the succeeding machine. This waste is generally placed in cans and collected at regular intervals and carried to the picker room and thrown back into the mixing bins to be used over again and is considered as raw stock. Of course, it is understood that the different kinds of grades of cotton are kept separate. This method includes all machines up to the slubber and the procedure is the same as described in a previous article.

OPENING AND PICKING.

The cotton is passed through an opener and two processes of picking, the weight of lap being about 40 pounds at the breaker and 39 pounds at the finisher, the speed of the beater being 1,500 revolutions per minute. This is a little faster speed than is used for higher class of yarns, because there is apt to be more dirt and foreign matter in the lower grades of cotton and the more beats per inch you have the more it tends to clean your cotton.

There is a limit, however, to the speed at which to run the beater, because, if run at too great a speed, it will tend to put nips into the cotton which are impossible to comb or card out unless you take out the whole bunch of fibres contained in the nip, which is a needless waste of good cot-

ton when a little care at the beginning would have saved the nip. Nips make bunches in the yarn and show up clearly in the finished cloth, and while it is impossible to make yarn without nips, it is always the object of all good carders to make as few as possible.

CARD SETTINGS.

The settings at the cards should be as follows: Flats from cylinder 10-1000ths to 12-1000ths inch; doffer to cylinder 7-1000ths inch; licker-in from cylinder 10-1000ths; feed plate to licker-in 12-1000ths to 20-1000ths inch, according to what style of nose you are using; licker-in knives to licker-in about 12-1000ths inch; back and front knife plates 12 to 17-1000ths inch, from cylinder wire at the lower edge, although the setting distance of the front knife plate varies because this helps to regulate the amount of flat-top waste taken from the cotton on the cylinder; cylinder screen from cylinder wire 20-1000ths to 24-1000ths inch at its nearest point to wire, which is the center or directly underneath the center shaft of cylinder. The outer edges of the screen are generally set about ¼ of an inch away from the wire. The sliver should weigh about 65 grains to the yard at the front of the card, the production being about 800 pounds per week of 60 hours.

THREE PROCESSES OF DRAWING.

The work is then put through three processes of drawing, the revolutions per minute of front roll being 400, the production per week 1,650 pounds per delivery, the sliver weighing about 70 grains per yarn. The settings for finisher drawing frame are as follows: front roll to second, 1⅝ inches; second roll to third roll, 1½ inches; third roll to back roll, 1⅝ inches. The slubber hank should be about .40 hank; first intermediate 1.50 hank; second intermediate five hank. The spinning frame makes the required 1-20s yarns from five hank roving. Some overseers use one less process of drawing and add one process of fly frames, in which case the hank roving at the different processes of fly frames would be as follows: slubber .40; first intermediate 1.10; second intermediate 2.70; fine frame, five hank.

To make the yarn 2-20s, it is doubled at the twister, two ends of 20s yarn being fed and being twisted into one thread of yarn at the front, but being called 2-20s yarn.

Bleaching and Finishing.

If bleached in the ordinary way, running through machine rollers in a bleaching works, the pieces will be drawn and sometimes damaged. Each piece is laid separately in a kier until the full amount of cloth has been placed therein, a solution of caustic potash at 5 degrees Tw. is run in, and boiled for 10 hours. Wash well and boil again with a 4 degrees Tw. of caustic potash. Wash well, and give a solution of sulphuric acid ½ degree Tw. Wash well, and chemic with ½ degree Tw. chloride lime, for about four hours. Give an acid bath of ½ degree Tw. sulphuric acid. Wash well until all trace of acid has been eliminated.

The goods should be dried on a tenter frame. A light starching to give more weight can be given of 4-6 oz. cornstarch per gallon, starch to be boiled for one hour. Run through a rubber rolled mangle and dry on a tenter frame. If a half bleach is required, a boil of caustic potash and an acid bath are all that are required.

CRINKLE OR SEERSUCKER

This weave can be produced on less harnesses, but this number allow more freedom for heddles.

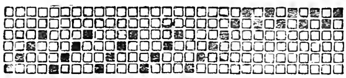
Crinkle or seersucker is a wash fabric composed of cotton, cotton and silk or all silk, and can be easily woven in any power loom adapted to light and medium weight cotton goods, such as the old style roller loom, or the more modern dobby or jacquard. To make this fabric

TWO BEAMS ARE NECESSARY

as the crinkle or shrunken stripe is its peculiarity, hence the name. The part of the warp (which forms the crinkle in the cloth) is dressed on a separate

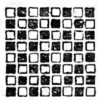
beam and has only sufficient weight placed upon it to allow it (crinkle warp) to form a shed properly during weaving.

The ground or body of the cloth may be dressed upon one or more beams according to the difference in



Drawing-in Draft.

Reed Plan.



Plain Weave for Crinkle.

take-up, created by using combination weaves to form fancy corded or ribbed stripes in the body of the cloth.

In a good many crinkle or seersucker fabrics plain weave is used entirely, with the cloth construction exactly the same in all portions of material, except wherein the extra take-up of the yarn creates the crinkle effect. To-day, it is not a general practice to make the crinkle stripe identical in construction with the ground of the fabric. This is due to several causes: First, the use of a greater amount of yarn where the crinkle is made develops a much better crinkle and in addition causes somewhat better weaving. Second, it makes it possible for a greater amount of variety in cloth pattern to be used. A good many would consider the weave used on these crinkle stripes to be plain, and, generally speaking, this is a correct designation, but there is a difference noted from the ordinary plain weave in that instead of having a single thread in each heddle eye there are two threads drawn as one. Naturally, a cloth of this character can be made just as easy as an ordinary plain fabric, so far as the weaving operation is concerned. When the yarn is drawn in two threads per heddle, the crinkle portion of the warp is reeded four instead of two ends per dent, which is noted in the body of the fabric.

If we desired to make a cloth having a plain stripe for 20 threads and a crinkle stripe for 10 threads, draw the plain or ground threads on four harnesses, straight draft, 1, 2, 3, 4 and the crinkle threads on two harnesses 1, 2 and reed the whole warp two ends per dent straight across from selvage to selvage.

The crinkle effect is produced by allowing this part of the warp to weave in slack, while the ground warp has the regular weight or tension placed upon it. In this way the slack warp very naturally forms a puckered or shrunken stripe in the fabric.

This fabric has been in large demand at various times, and is used extensively for ladies' wear in the line of summer outing dresses, petticoats, etc., and while the sale of such fabrics has been affected by fashion in the past and will be affected by fashion in the future, nevertheless, there are a large number of such styles which are sold just as regularly as ginghams or sheetings, although in somewhat smaller quantities. The reason why crinkle fabrics are sold regularly is because there are certain purposes for which they seem more desirable than about any other fabric, and inasmuch as the demand for articles composed of crinkle cloth is quite steady, it is certain that the production and sale will also be quite steady. Advertising has had quite a little influence in teaching consumers the cloth value of some of these fabrics, and is having an influence in the regular distribution.

A very good grade of crinkle cloth can be produced from the following:

STRIPE EFFECT (WARP PAT.)

Reed, 1150—30 inches width in reed; 1-30s cotton warp and filling. (Regular yarns), 56 picks filling.

Of course, each manufacturer usually follows his own ideas of economy in constructing a fabric, consistent with the conditions and suggestions submitted to him by the trade through his selling agents concerning the nature and style of a sample fabric to be produced.

Following is the finish for goods constructed as per stripe effect: Goods are run through the washer, then through the cylinders or dryer, and from dryer to tentering machine. This operation stretches the goods to the original loom width if desired, also acting as an auxiliary dryer, after which they are run through the calender, which machine gives the cloth the appearance of having been newly ironed.

Carding and Spinning Particulars.

The mills making the style of cloth described above belong to the second division of mills given in a previous paper, i. e., those using low and medium staple and grade of cotton. These mills, of course, use the average settings on all machines with proper relation to the length of staple, etc. Of course, crinkle or seersucker is made of different counts of yarn in different mills, but these do not vary enough so that any change is made, except in the spinning room, which will be mentioned later. The seersucker under description will be considered to be made of 1-30s cotton yarn. The raw stock used for this yarn should be about 1-inch staple.

IN THE MIXINGS

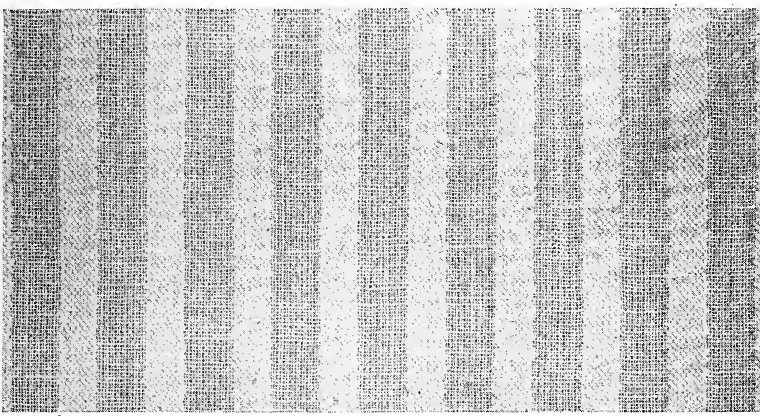
use other good waste, such as described in the last paper, also cut roving waste. As in previous mixings, make them as large as possible, and when possible put them through a bale breaker, and it would be a good idea to let the cotton stand as long as possible before using it (after mixing, of course). This allows it to expand and dry out and it is then in a better form for use. Different mills use different processes for the purpose of dyeing the cotton out and making the cotton mixing

AS FLUFFY AS POSSIBLE.

It is the general custom in up-to-date mills to use a blower in connection with the bale breaker. The cotton is fed into the bale breaker and junks are torn apart by the spikes on the rolls of the bale breaker and then the cotton is delivered on to an endless apron, which carries it over a chute into which the cotton drops. This chute allows the cotton to slide into a fan or blower, which revolves at a high rate of speed and the draft carries the cotton through, trunking either directly to the bin in which it belongs or drops it on to an endless lattice, which may be shifted to allow the cotton to drop into the bin where it belongs. It must be understood that cotton or raw stock is

COMPRESSED VERY TIGHTLY

into bales, and if some means were not taken to help the cotton regain its



Crinkle or Seersucker.

natural fluffy state the machines would have to do a great deal of heavy work for which they are not wholly built. Thus the bale breaker tends to separate the matted masses as they are taken from the bale and the air from the blower helps to air, dry and restore the cotton to a fluffy state, which is so desirable to obtain among carders. The cotton is allowed to stand as long as possible so that it will expand and dry out as much as possible before using, as the cotton in the bale collects more or less moisture from being in the cotton storehouses in general use.

The cotton used for 30s yarn is generally passed through

TWO PROCESSES OF PICKING,

if a blower is used. A good weight per yard of lap is 16 ounces and total weight of lap is 40 pounds at the breaker and 14½ ounces per yard and 39 pounds per lap at the finisher. The speed of the beater is the same as has been given for mills of the second division. At the card the draft should be about 100 to 110, which will give the weight of the sliver about 65 grains. The doffer should be speeded so as to give about 800 pounds production. The sliver is then generally run through three processes of drawing frames, a good draft of which is as follows: breaker, 5 plus; intermediate 4—; finisher, 6; which will give the following weight of sliver per yard; at the breaker 74 grains; intermediate, 79 grains, and finisher, 75 grains. Be careful of the settings of the rolls at the drawing. The hank roving at the slubber should be .45; at the first intermediate fly frame 1.40; at the second intermediate, or, as it is sometimes called, the roving frame, 3.5 hank and jack or fine frames, 7 to 7.5 hank. The roving is then carried to the spinning room where it is spun into 30s yarn. If yarn of a little higher or lower count is desired the draft gear is generally changed at this frame to give the required count.

Dyeing Particulars.

LIGHT BLUE.

For 100 pounds yarn, 1½ per cent immedial indone B pat.; 1½ per cent immedial sky blue conc.; 5 per cent sodium sulphide; 10 per cent crystalline Glauber's salt; 3 per cent soda ash; enter at boil, boil one hour; wash well with water.

DARK BLUE.

For 100 pounds yarn: 8 per cent immedial indone blue pat; 10 per cent sodium sulphide; 15 per cent crystalline Glauber's salt; 3 per cent soda ash; enter at boil, boil one hour; wash well with water.

BLACK.

For 100 pounds yarn: 20 per cent immedial indone blue pat; 10 per cent sodium sulphide; 15 per cent crystalline Glauber's salt; 3 per cent soda ash; enter at boil, boil one hour; wash well with water; second bath, one-half above proportions.

OLIVE GREEN.

12 per cent pyrogene olive N; 6 per cent sodium sulphide; 20 per cent Glauber's salt; 3 per cent soda ash; enter at boil, boil one hour; wash well with water.

BROWN.

12 per cent pyrogene brown G; 8 per cent sodium sulphide; 20 per cent Glauber's salt; 3 per cent soda ash; enter at boil, boil one hour; wash well with water.

FINISHING PROCESS.

Starch with six ounces cornstarch; six ounces cocoanut oil white softening; one gallon water; boil starch for 45 minutes; rinse through starch mangle; dry on tenter frame.

COTTONADE

Cottonade is a heavy, coarse, single cloth, made of single yarn, generally 1-20s cotton warp and 16-cut wool spun, weaving woolen principle, all-cotton shoddy filling. It is used as a trousering, an important feature of which is the low selling price of the finished garment.

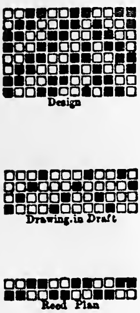
It is best adapted to the old-style roller or cam loom, and is made and woven on four harnesses, generally the $\frac{2}{2}$ twill, either right or left hand, or herring-bone weave effect (twill running at angle of 45 degrees).

It is a narrow fabric, being set in the reed 30 inches, and receiving very little finish, and is sold at 27 inches in width.

THE PATTERNS

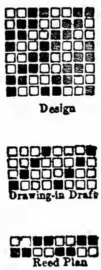
are usually on the dark side with a small percentage of bright color added to improve the tone: Black, dark slate and dark drab for ground colors, and an occasional red, pearl, light brown or an equivalent color to brighten the whole pattern.

In making a cottonade the object is to produce a cheap single-cloth trousering composed of a rather coarse but fairly strong single warp thread and a thick or lofty single filling



$\frac{2}{2}$ 45° twill

Herring-bone effect.



$\frac{2}{2}$ 45°

Right-hand twill.

thread, which combination in certain proportions gives the fabric a weighty appearance.

THE FILLING

is usually an all-cotton shoddy filling, made from old dark colored cotton rags. By willowing and picking, the yarn is brought to the carded state. The fibres in an all-cotton shoddy are short, due to the process of reduction, as stated above.

From the pickers the shoddy is run through the first and second breakers and then through the condenser or finisher card. The spool drum containing the roving is then taken from the condenser card and placed upon the mule to be spun upon tubes, ready for the weaver.

The fibres being short, the shoddy will lose from 15 to 20 per cent of its weight during the carding and spinning, also from the 3 to 5 per cent of waste made by the weaver.

To find stock at picker:

Cottonade, 30 inches in reed; 32 picks; 16-cut cotton (woolen principle) shoddy; 32 times 30 equals 960 yards divided by 300 equals 3.2 ounces filling, plus 5 per cent loss equals 3.18 ounces; 16-cut times 300 equals 4,800 divided by 16 ounces equals 300 yards per ounce; 3.18 ounces at loom plus 20 per cent loss in carding, spinning equals 3.82 ounces at picker per yard of cloth.

Cottonade, reed 800-2 ends per split, 30 inches wide, 32 picks, 16-cut cotton (woolen principle) shoddy, 1-20s cotton warp.

Finish about 27 inches. To finish run through dry hot press.

Weigh 4¼ ounces about.

Warp pattern:
10 Black.
2 Dark slate.
1 Red.
1 Black.
2 Dark drab.
1 Black.
1 Red.
2 Dark slate.

Design—regular $\frac{2}{2}$ 45 degree right hand twill.

THE WEAVING.

To weave in roller loom, this warp is drawn in 1, 2, 3, 4, on four harnesses, these harnesses being suspended in the loom from the rollers by means of straps attached to hooks on the top of the harness or heddle shafts. The harnesses are then fastened to the loom treadles by means of jackstraps running from the bottom of the harness to said treadles, the treadles being operated by a series of cams, consistent with weave effect desired.

These cams are so arranged on the cam shaft that in revolving they strike the treadles, and this action, pulling the harness up and down, opens the shed. (Note—in a roller loom two or more harnesses are always attached to one top roller, and of necessity whatever pulls one down must pull the mate harness up, the cams always being arranged to permit this.)

In applying this weave the first and third harnesses are strapped to the first top roller and the second and fourth strapped to second top roller. This being the case, the action of the cams in opening the shed causes the raisers and sinkers on each successive warp thread in the repeat of the weave to start one pick later than that of the thread preceding it, thereby forming a twill line.

A warp to be woven $\frac{2}{2}$ twill, drawn on four harnesses 1, 2, 3, 4, and strapped up in this manner, and having the cams set properly should shed thus: First pick, first and fourth up; second and third down. Second pick, first and second up; third and fourth down. Third pick, second and third up; first and fourth down. Fourth pick, third and fourth up; first and second down.

The herring-bone weave effect is produced by drawing in the warp from front to back and back to front in the harness and using the same set of cams, set in the same manner and position, and the same harness strapping as in making a straight right hand twill.

Carding and Spinning Particulars.

For this class of goods the cotton yarn is generally made and spun in the same way as wool and worsted yarns, and is generally made in mills and on the machinery generally used for making worsted or woolen yarns. It will be understood that the methods of making yarn in a cotton mill and a woolen mill are entirely different, both as to the number of processes and the kind of machinery used. In fact, the fundamental principles for spinning yarn are entirely different in each mill, and as we are describing cotton fabrics in these articles we will proceed just as if the yarn used for this class of goods was made in a cotton mill and sold to a woolen mill, which is sometimes done.

THE RAW STOCK.

The raw stock used for this class of fabric would be of a low grade and generally mixed with comber or even card waste; the percentage of waste used would depend a great deal on the count of yarn to be made. In the fabric under description the count of the cotton yarn is 1-20s. The raw cotton would be opened up and run through a bale breaker, or it may be opened at the bin and not run through the bale breaker, which will save the expense of one process, but the cotton will not be opened up as well, a more even yarn being made when bale breaker is used. As the cotton is opened at the bin it is mixed with the carded or combed waste in the proportion required, the cotton layers being taken from the bale and pulled apart as much as possible so as to let the air get at them and also so as to lighten the work of the opener. The cotton is taken and put into the opener which is generally attached to the breaker picker, either directly or indirectly by having the cotton carried through trunking (through which it is blown by a draft of air from a fan on the opener) which connects with the back part of the breaker picker. The opener machine may be on the same floor or may be situated on the floor above or below the breaker picker; but in mills, as they are now constructed, the opener is on the same floor and is considered as a part of the breaker picker.

PARTICULARS TO BE OBTAINED.

For this count of yarn the speed of the beater should be about 1,050 revolutions per minute. The hopper on the opener should always be kept more than half full of cotton and it should be as large as possible, the reason for this being that a more even amount of cotton will always be presented to the pin beater by the lifting apron than when the hopper is less than half full. This is important, not only in reference to "cottonade fabrics," but also all classes of goods, because if it is less than half full it is apt to cause uneven yarn. The speed of the beater on the breaker and finisher pickers should be about 1,500 revolutions per minute, which gives the beats per inch about 42. The weight of the lap at the breaker picker should not be less than 40 pounds and at the finisher less than

39 pounds. A 39-pound lap gives a weight of lap per yard of 14½ ounces. The card is set so as not to take out too much waste, and wider settings are used than those given in a previous article. The draft used should be 100, the sliver at the front weighing 65 grains. Production at the card should be at least 900 pounds. The sliver is then run through two processes of drawing, the weight of sliver at the finisher being about 72 grains per yard. The production per delivery of the finisher drawing frame should be at least 1,600 pounds per week of 60 hours and the percentage of lost time at this machine not more than 15 per cent. The slubber is the next process and the hank roving made at this machine should be about .40. Three-process fly frames are used and the hank roving at the different processes should be as follows: 1st intermediate 1.10 hank; 2d intermediate 2.75 hank; five-frame from 4.50 to 5.00 hank. Care should be taken that the rolls are not spread too far apart on these machines and a good setting for rolls of this stock for slubbers and fly frames is as follows: Front roll to middle spread to 1¼ inches; middle roll to back roll 2 inches. The yarn is then taken to the spinning room where it is spun into 20s yarn, a soft twist being used.

Dyeing Particulars for Raw Stock.

BLACK.

For 100 pounds: 18 per cent pyrogene bl ck B. D.; 12 per cent sodium sulphide; 8 per cent soda ash; 70 per cent salt. Enter at boil, boil one hour, and wash well in water.

PEARL.

One per cent pyrogene gray B; 2 per cent sodium sulphide; 2 per cent soda ash; 5 per cent salt. Enter at boil, boil one hour.

LIGHT BROWN.

Five per cent pyrogene brown G.; 5 per cent sodium sulphide; 2 per cent soda ash; 5 per cent salt. Enter at boil, boil one hour, wash well.

RED.

Five per cent rosanthrene red A.; 25 per cent Glauber's salt; 3 per cent soda. Enter at boil, boil one hour, rinse, diazotize for one-quarter hour with nitrite soda and muriatic acid, rinse.

Develop with beta naphthol and caustic soda for one-quarter hour. This red is brighter and faster than primuline red.

DIAZOTIZING BATH.

One and one-half per cent nitric soda, 5 per cent muriatic acid, 20 degrees Be.

DEVELOPING BATH.

One and three-quarters per cent beta naphthol; 3 per cent soda ash.

DARK SLATE.

Two and one-half per cent immedial direct blue, B pat.; ¾ per cent immedial olive, B pat.; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent Glauber's salt. Enter at boil, boil one hour.

DARK DRAB.

One and one-half per cent immedial brown, pat.; ¾ per cent immedial olive, B pat.; ¼ per cent immedial black, N. B. pat.; 20 per cent Glauber's salt; 2 per cent soda ash; 5 per cent sulphide soda. Enter at boil, boil one hour.

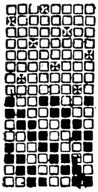
COTTON WORSTED—NEN'S WEAR

Cotton worsted men's wear is a fabric composed of either 2-20s or 2-30s cotton warp and filling, and receives either a dry or wet finish. The weave, color arrangement and general construction are an exact duplicate of the finest worsted goods of the present time.

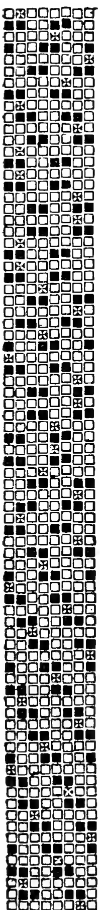
This fabric is used in the manufacture of men's suitings and trouserings, retailing at $7 to $12 per suit, for the middle class trade, and in effect has the neat, dressy appearance of an imported cloth of high grade.

It is made in a light-weight grade at 6 to 6½ ounces for spring and fall, and heavy weight at 8 to 8½ ounces for winter wear, both grades being produced in stripe, check and indistinct plaid patterns.

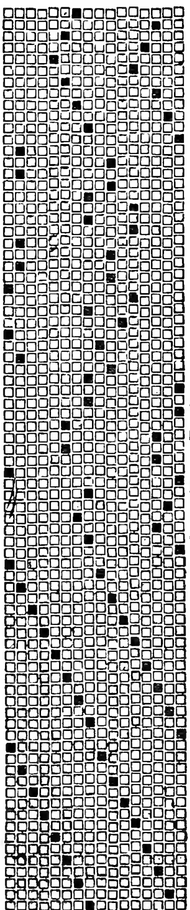
Cotton worsted men's wear is usually woven on any loom, having either



Weave harness chain.



Design—Light Weight—Stripe.



Drawing-in Draft.

Reed Plan

4x1 or 4x4 filling boxes, and having a head motion attached of from 16 to 25 harness capacity. Most all weave effects and combinations of weaves known in the worsted men's wear trade can be applied to this fabric. Care should be taken, however, in construction of weave, as the weave, when used in a worsted to produce a tightly bound rib effect, may appear more open in cotton worsted men's wear, as the worsted fabric shrinks when scoured in finish and the cotton fabric is finished dry and is practically the same as when taken from loom, of course, allowing for percentage of contraction between reed and cloth roll. Cotton worsted men's wear is usually made one face end and one back end, and reeded four ends per dent.

THE FACE WEAVE,

when a twill or fancy combination, is balanced on the back of the cloth by using an eight harness satin (warp effect on back) five as counter. The face weave should always be properly balanced. In making this style of goods, or a warp back fabric, the extra is placed there for the purpose of adding weight to the cloth, and if of a tighter nature, the face of the cloth will present a puckered or uneven appearance.

To dry finish cotton worsted men's wear, the yarns of which have been dyed from dry or cheap colors, that will not stand washing, the goods are taken from the loom and inspected, measured and sheared. Shearing is a process which means running the cloth through a machine, having a cutter composed of a series of blades set in a frame, which revolves in similar manner to that of a grass mower, the cloth being kept taut by being passed over and under several rods and rollers, which also remove wrinkles, and allow the cloth to be presented evenly to the cutter. The purpose of shearing is to remove all foreign substances from the face of the cloth, such as knots, lumps, etc., and the effect is a smooth, even cloth that readily takes on the appearance of a high-class worsted, after being run through the hot press.

The steam gauge on a hot press should register 50 pounds and the dial

135 pounds roller pressure when the cloth is run through this press. The effect of the pressure of the steam-heated rollers upon the cloth is to remove all wrinkles, liven up the colors, and to retain the width of cloth as taken from the cloth roll at the loom.

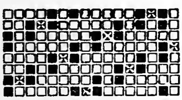
After being pressed, the cuts of cloth are rolled or lapped into bolts, the ends of which are then stitched, the tags sewed on and the goods are ready to case and ship.

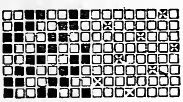
THE COLORS

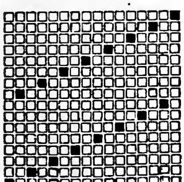
used in cotton worsted men's wear are black, brown, light and dark shades of blue, slate, drab and steel, and to liven up a pattern use an occasional end of maroon, green, pearl or sky blue.

This line is also made in a piece-dye fabric, constructed from 2-20 and 2-30 cotton warps, and 1-30s worsted and 1-20 cotton filling. These yarns are woven in the gray and the cloth scoured and dyed in the piece, black or blue. When finished, this fabric resembles a very heavy serge. Finish, 28 inches.

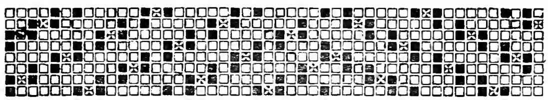
Piece dye—worsted men's wear; reed, 500—eight ends per dent; 33 inches in reed, including selvage, 32x2.

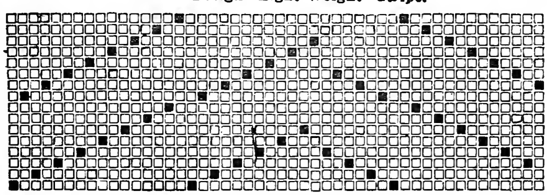

Design—Piece Dye


Weave Harness Chain

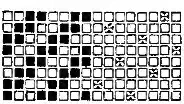

Drawing-in Draft


Reed Plan


Design—Light Weight—Stripe.


Drawing-in Draft.


Reed Plan.


Weave Harness Chain.

1 end face 2-30 cotton warp; 1 end back 2-20 cotton warp, $\frac{2}{2}$ twill face, 8 harness satin back, 5 as counter.

1 pick 1-30s worsted; 1 pick 1-20 cotton; 56 picks per inch.

LIGHT-WEIGHT MEN'S WEAR.

Reed, 900—four ends per dent, 6½ ounces; 31½ inches in reed, including selvage 32x2; 2-30s cotton warp, one face and one back; 52 picks 2-30s black cotton filling. Dry finish equals shear and hot press. Weave twill combinations for face; weave eight-harness satin for back.

HEAVY-WEIGHT MEN'S WEAR.

Reed, 800—four ends per dent, 8½ ounces; 31½ inches in reed, including selvage 32x2; 2-20 cotton warp one face, one back; 52 picks, 2-26s black cotton filling. Dry finish equals shear and hot press. Weave, can use same as light weights.

Carding and Spinning Particulars.

Cotton worsted fabrics, like cottonade fabrics, are generally made and spun in the same manner as wool and worsted yarns and made in woolen mills. There are a few exceptions, however, where they are made in cotton mills. The count of the yarn used

in cotton worsted fabrics varies from 20s to 36s, and is generally a doubled yarn. In the present article we will proceed as if the count of the finished yarn was to be 2-30s.

A mill making this class of goods would belong to the second division of mills (as classified in a previous article) i. e., a mill equipped with machinery for making yarns from low to medium grades of cotton.

THE MIXINGS

would be made in the usual manner, being run through a bale breaker into the mixing bin and at this point mixed with the sliver waste returned from the cards, drawing frames and combers (if there are any of these machines in the mill) and then it is run through an opener and through three processes of pickers. At the finisher picker laps of cut roving waste are mixed with raw stock in the proportion of three laps of raw stock to one lap of cut-roving waste. In using cut-roving waste and also sliver waste it should always be of the same length of staple. It is

THE GENERAL PLAN

to use cut-roving waste as fast as it is made and not allow it to collect until a large quantity is on hand.

The method employed in most mills is to collect the cut roving over a day (generally right after the noon hour) and take it to the picker room and run it through the roving or waste picker. From here it is run into a breaker picker and formed into laps of suitable weight. These are then mixed with the raw stock in the proportion above stated, as long as the cut-roving laps hold out (which should be as short a time as possible for obvious reasons). By doing this

A MORE EVEN YARN

is obtained than when the cut roving is allowed to collect for a week at a time before being put through the waste picker, because by the first plan you are mixing a small quantity of cut roving a good part of the time, whereas by the latter plan cut roving is only mixed with the raw stock once a week, while during the other five days nothing but the raw stock and sliver waste is being mixed. By the latter plan a more uneven yarn is bound to be made. The

SPEED OF THE BEATERS

on the different machines should not exceed 1,050 revolutions per minute at the opener, 1,500 revolutions per minute at the breaker picker, and on the intermediate and finisher pickers the speed should be slowed down so as not to exceed 1,450 revolutions per minute. This will give 42 beats to every inch of cotton fed to the finisher picker, which ought to be enough to thoroughly clean it. In giving the above speeds it is assumed that the rigid two-bladed type of beater is used. Different kinds of beaters, together with their advantages and disadvantages, will be given later when higher count yarns are described. The

WEIGHT OF THE LAP

at the breaker picker should be about 40 pounds or 16 ounces to the yard; at the intermediate about 37 pounds or 12 ounces per yard; at the finisher 39 pounds or 14½ ounces per yard. The settings at the card should be the same as described in previous article, per weight of sliver being 60 grains per yard and the production 850 pounds per week of 60 hours. The work is run through three processes of drawing, revolutions per minute of front roll at each process being 400 and the weight of the sliver at the finisher drawing 70 grains per yard. In order to help produce a perfect yarn, it is always a good rule never to draw more than you double at the drawing frame. For example, if you are feeding six ends at the drawing your draft should be six or under. The

PRODUCTION OF THE SLIVER

at the drawing frame should be about 1,600 pounds per delivery for a week of 60 hours. The next machine is the slubber, the hank roving at the front being about .40.

The yarn is run through three processes of fly frames and the hank roving made at each should be as follows: First intermediate, 1.20; second intermediate, 3.00; fine frame, 7.25 to 7.50. The yarn is then taken to the spinning room and made into 30s

yarn; from here it is taken to the twister and made into 2-30s by doubling two yarns of single 30s yarns together.

Dyeing Particulars.

BLACK FOR YARN.

15 per cent immedial black N. N.; 12 per cent sodium sulphide; 5 per cent soda ash; 20 per cent Glauber's salt; enter at boil, boil one hour; wash well.

DARK BROWN.

8 per cent immedial dark brown A.; 1 per cent immedial yellow D.; ½ per cent immedial black N. B.; 10 per cent sodium sulphide; 5 per cent soda ash; 20 per cent Glauber's salt; enter at boil, boil one hour; wash well.

DARK BLUE.

3 per cent immedial indone B. conc.; 3 per cent immedial indone R. conc.; 3 per cent immedial direct blue B.; 8 per cent sodium sulphide; 5 per cent soda ash; 20 per cent Glauber's salt; enter at boil, boil one hour; wash well.

PEARL.

For 100 pounds yarn: 2 ounces immedial black N. R. T.; 8 ounces sodium sulphide; one pound soda ash; 5 per cent Glauber's salt; enter at boil, boil one hour.

DRAB.

For 100 pounds yarn: 2 ounces immedial black N. B.; 12 ounces immedial cutch G.; one pound sodium sulphide; 5 pounds Glauber's salt; enter at boil, boil one hour.

SLATE.

For 100 pounds yarn: 2 pounds immedial direct blue B.; three-quarters of a pound immedial olive B.; 5 pounds sodium sulphide; 10 pounds Glauber's salt; 2 pounds soda ash; enter at boil, boil one hour.

STEEL.

For 100 pounds yarn: 12 ounces immedial black N. B.; 2 ounces immedial yellow D.; 2 pounds sodium sulphide; 2 pounds soda ash; 5 pounds Glauber's salt; enter at boil, boil one hour.

GREEN.

5 per cent pyrogene yellow M.; 5 per cent pyrogene green B.; 10 per cent sodium sulphide; 20 per cent Glauber's salt; 5 per cent soda ash; enter at boil, boil one hour; wash well.

MAROON.

25 per cent Glauber's salt; 6 per cent Rosanthren C. B.; 5 per cent soda ash; enter at boil, boil one hour; wash.

Diazotize: 1½ pounds nitrate soda; four pounds hydrochloric acid; turn for 15 minutes; develop two pounds beta naphthol; 2 pounds soda ash; turn for 15 minutes; wash well.

SKY BLUE.

2 pounds immedial sky blue; two pounds sodium sulphide; 5 pounds soda ash; 15 pounds Glauber's salt; enter at boil, boil one hour.

FIGURED SILK (LENO) WAISTING

Figured waisting is a light-weight wash fabric, generally composed of 1-40 cotton warp and either single or two-ply silk or spun silk filling, 1-60 silk and 2-60 mercerized or spun silk filling being in great favor for the past few years.

This fabric can be woven on either the dobby or jacquard loom having single or double box motion. Very elaborate and popular styles are created by using

FANCY GRANITE WEAVES

(filling effect) for ground, and for figuring use the filling effect of diamond, spot, crossed or curved twill weaves. These are so regularly arranged as to produce apparent jacquard patterns. Persian stripes can be produced by using bright colored extra warp threads and arranging the weave so as to raise them on the face of the cloth in Oriental or floral designs. Spots are sometimes woven into this fabric by using extra warp and clipping the long floats of yarn off the back of the cloth.

Very elegant styles are made by introducing leno weaving by means of white and colored fancy yarns to produce open or lace work in the cloth.

Figured waisting is made in both chambray and stripe pattern, always having white filling. For chambrays the following

COLORS

are serviceable: dark blue, light blue, brown, pink, red, pearl, steel, light green, tan, ecru, etc.

The combination of cotton warp and silk or spun silk filling creates a silky sheen on the face of the fabric as the light strikes it, and this in itself is its most important selling feature.

IN WEAVING

this fabric the take-up roller should be covered with fine sandpaper and this paper presents a more even surface to the cloth and does not draw the filling, as is often the case where perforated tin is used as a covering on the take-up roller. The perforations usually cause small rough particles of tin to stick out prominently, and these catch on the long floats of the filling figure, and as the loom continues to run, the yarn clings to the roller and draws the filling, thereby spoiling the symmetry of the figure and causing imperfect cloth.

The tin covering very often causes clouded or thick and thin places in the cloth. Especially is this so when using a fine silk filling, and a great number of picks per inch.

To finish figured waisting the fabric is washed in a solution of soap and cold water, then dried by being run through the hot press. After the press of calender, the goods are folded on a folding machine (not lapped) in the same manner as sheeting, and after folding, each separate piece or cut is doubled in half and then wrapped in stiff paper, to keep out all dirt, after which it is ready to pack and ship.

(SILK) FIGURED WAISTING.

Reed, 1,300, 2 ends per dent; 38 inches in reed, to finish at 36 inches. 1,300 means 1,300 splits to 36 inches of reed. Warp 1-40s cotton; filling 1-60s silk filling, 64 picks. Take-up of warp during weaving, 15 per cent; 1,300 reed by 38 inches equals 1,372 splits; 2 ends to 1 split equals 2,744 ends plus 40 ends for selvage equals 2,784 total ends in warp.

WARP PATTERN.

16	White.	3 times.
2	Light blue.	
6	White.	
2	Light blue.	
16	White.	
8	Cadet blue.	
2	Sky blue.	
2	Cadet blue.	
2	Sky blue.	
12	Dark blue.	
2	Sky blue.	
2	Cadet blue.	
2	Sky blue.	
8	Cadet blue.	
134	ends in pattern = 67 splits.	

19 repeats of weave and pattern plus 40 splits or 80 ends.

FIGURED (LENO) WAISTING.

Reed, 1,400—ends per dent, 2; 34½ inches in reed, including selvage; finish, 28½. Scour and calender.

WARP PATTERN.

88	Red 1-40 cot.
1	Black leno 2-20 merc.
4	White 2-40 cot.
2	White leno.
4	White.
2	White leno.
4	White.
2	White leno.
4	White.
1	Black leno.
112	ends = 68 splits.

Weight one yard, 2,286 ounces.

1,752 ends + 15% take-up = 2,061 yds. 1-40 cot. =	.981 oz.
40 ends + 15% take-up = 47 yds. 1-40 cot. =	.002 oz.
304 ends + 15% take-up = 358 yds. 2-40 cot. =	.034 oz.
38 ends black + 25% take-up = 50 yds. 2-20 merc. =	.009 oz.
114 ends white + 25% take-up = 178 yds. 2-20 merc. =	.034 oz.
56 picks × 34½ in. = 1,932 yds. 2-60 merc. =	1.221 oz.
Total	2.286 oz.

Carding and Spinning Particulars.

Only mills having up-to-date machinery and also up-to-date ideas can hope to make figured silk leno. This class of goods requires a great deal firmer yarns than the other cloths that have been previously described, and these yarns are made in the third division of mills (as classified in a pre-

vious article), i. e., mills making yarn from middle to high-grade cotton. The

COUNTS OF YARNS

for this class of goods vary from 30s to 60s warp and from 40s to 80s (single or double) filling. The filling yarn is generally mercerized and a great many times extra silk ends are used to produce a certain silk effect in the cloth. For the carding and spinning particulars we will consider the warp made up of 1-40s cotton yarn and the filling of 2-60s yarn.

THE COTTON USED

should be of a good grade and a great deal of Allan seed cotton is used. This is generally about 1⅛-inch staple and should be as clean as possible.

In mixing this class of cotton, it is very important that all the bales mixed should be of the same length of staple, and the overseer, or in large mills both the overseer of carding and the cotton sampler, sample the cotton from every bale, and if it is not up to the standard staple and grade, the bale is laid aside either to be taken back by the cotton broker or used for making yarns which can be made out of a shorter staple cotton. After this the cotton is put through a bale breaker (if the mill has one which it should) or the cotton may be mixed by hand, care being taken when this latter method is used that the layers of cotton taken from the bale are pulled apart as much as possible. The ones in charge of

THE MIXING

should watch the men while they are pulling the bales of cotton apart to see that they do not take too large layers from the bale and throw them into the mixing bin, which they will do if possible so as to get through with the job quickly, for it is dirty work at the best. The bins should be made as large as possible, so as to accommodate a large mixing at one time, as large mixings help to make more even yarn than small ones.

IN SOME MILLS

it is the custom to use two bins for mixing the same kind of cotton. The mixing is done as above described. But one bin is emptied at a time; the cotton in the other bin is allowed to dry out while that from the first bin is being used. Of course, when one bin is empty it is immediately filled up again and the cotton is allowed to dry out in it until the second bin is emptied of cotton. When cotton is put through a bale breaker or any machine which opens the cotton up, it is only necessary to use one bin, and the cotton does not have to remain to air out, but may be used right away. The good waste from machines up to the slubber are used in the mixing, and cut roving is run in at the finished picker (it having first been run through the roving waste machine and made into laps at a breaker picker). The raw cotton is taken from the bin and put through an opener and

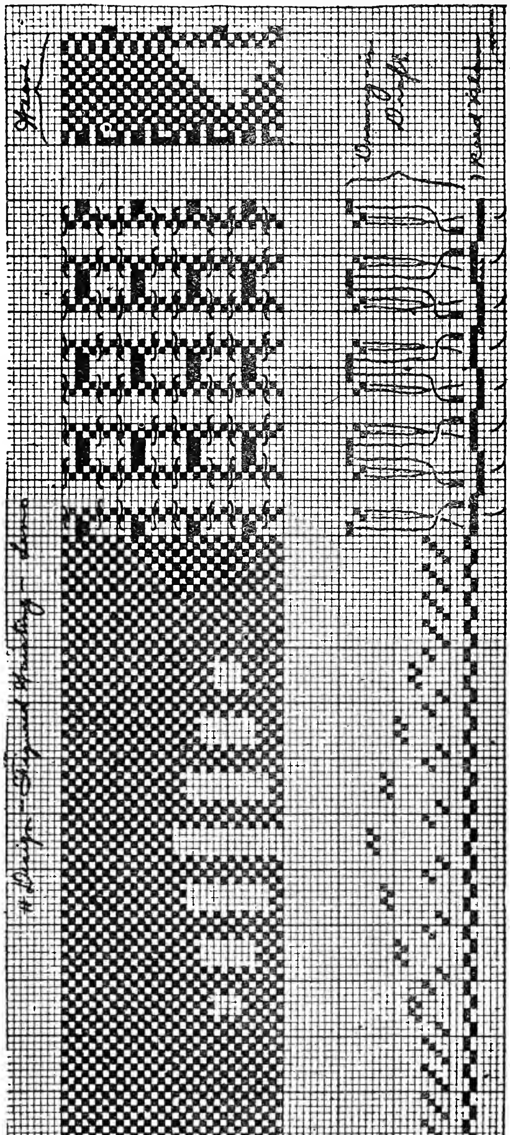
TWO PROCESSES OF PICKING.

The speed of the opener beater should be about 1,000 revolutions per minute, the breaker and finisher beater (two-bladed) about 1,400 to 1,450 revolutions per minute. It may seem strange that the speed of the beaters on the opener and pickers should be about the same as when low-grade cotton was used, because the general rule followed is that if longer stapled cotton is used, the less will be the speed of the beater, because with longer stapled cotton a highly speeded beater is apt to and does put neps into the cotton, but it is necessary to run the beater at a higher rate of speed for this class of cotton, because it is very dirty.

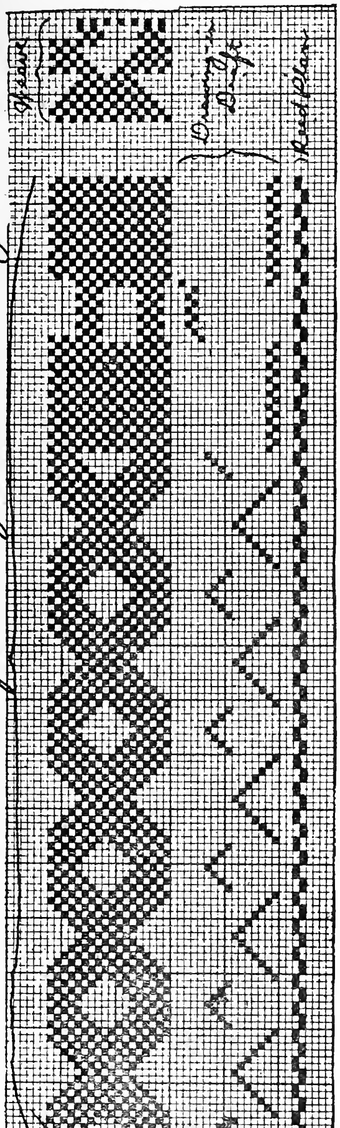
EXPERIMENTS

should be made with the beater in order to get it to run just fast enough so that it will take out the dirt and foreign matter in the cotton, and the above speeds are given only as a basis from which to work. The weight of laps at the breaker picker should be about 16 ounces to yard of laps and at the finisher about 11 ounces to yard of lap, or for the finer counts 10 ounces per yard of lap may be used. The total weight of the lap is 35 pounds and at the finisher picker receiving about 42 beats of the beater for every inch feed. The method of finding the beats per minute is to multiply the revolutions per minute

of beater to one revolution per minute of feed rolls (this may be calculated through the gears on the picker in the usual manner). Multiply revolutions per minute of beater by 2 (or 3 if a three-bladed beater is used). Divide this product by the circumference of the feed roll. For example, suppose that the beater made 197.5 revolutions per minute and was a 2-



bladed beater; then 197.5 times 2 equals 395 divided by 3 (diameter of



Design - Figured Silk Waisting

feed roll) times 3.14 plus equals 41.9 beats per inch. Ans.

The next machine is the card, and at this machine we see changes. In the first the wire fillets on the cylinder and doffer are finer. A good sized wire to use is 35s on the cylinder and 36 or 37 on doffer and top flats. All parts are set closer to each other with the exception of the nose of the feed plate in relation to the licker-in. The feed plate should be set so that the licker-in will not take the fibres being delivered before they are free from the bit of the feed roll and feed plate. The speed of the top flats is sometimes increased by lagging the top flats driving pulley. This is for the purpose of having more working flats on the cylinder and which consequently results in taking out more waste. The

SPEED OF THE DOFFER

is a great deal less and thus the production is smaller, for it is quality first and quantity second with this class of goods. Of course, the quantity must be looked at to see that the production is as large as possible, but it must not be at the expense of quality. Sometimes on the finer counts of yarn the speed of the licker-in is reduced, and it is found to be of great benefit to the sliver delivered at the front, because it not only cleans the cotton more thoroughly, but it also tends to

KEEP THE NEPS OUT

and not to put them in. If carders have not tried this it might be a good plan to lag the licker-in pulley to 10 or 10½ inches diameter, instead of nine inches as it now is when using long staple cotton, especially Sea Island cotton. The draft of the card should be about 125 to 140, the sliver at the front weighing about 45 grains to the yard and the production of the card being not over 500 pounds per week of 60 hours. Grind cards both often and light. The cotton for this class of goods is combed and

BEFORE REACHING THE COMBER

passes through the sliver lap and ribbon lap machines, generally 14 ends up at the sliver lap and six laps at the ribbon laps. The weight per yard of lap at the ribbon lap machine should be about 260 grains. As the ribbon lap machine is at the drawing frame, nev-

er draw more than you double. In some mills the ribbon lap machine is not used, but where it is used it saves about 1½ per cent waste at the comber.

THE COMBER

should be properly set so as to take out about 16 per cent waste, the weight of sliver at front being about 45 grains to yard. The speed of comber for this class of cotton should be not over 90 neps per minute. After the comber two processes of drawing are used, the sliver at the finisher weighing 70 grains per yard. The settings of the rolls should be as follows: front to second 1⅜ inches, second to third 1½ inches, and third to back 1⅝ inches.

THE SLUBBER ROVING

should be .55 hank and the first intermediate fly frame roving 1.50 hank; second intermediate 4.00 hank, and 12 hanks or packs for spinning 60s and .55 hank slubber 2.00 first intermediate and 8.00 fine frame for 40s. Care must be used in setting the rolls as well as in the adjustment of other parts of the fly frames. The cotton is taken to the mule spinning room and spun into the counts mentioned above, from here it is taken and put through the different processes required and sent away to be mercerized.

Dyeing Particulars.

Following are the dyeing particulars for figured silk and leno waisting:

DARK BLUE.

10 per cent tetrazo sulphur blue B., 8 per cent sulphide soda conc., 3 per cent sal soda, 50 per cent common salt. Enter at boil, boil one hour, rinse quickly in cold water and give three washings in cold water.

The tetrazo sulphur colors can be obtained from the New York and Boston Dyewood Company.

BROWN.

10 per cent tetrazo sulphur brown R., 1 per cent tetrazo sulphur brown G., 9 per cent sulphide soda conc., 3 per cent sal soda, 80 per cent common salt. Enter at boil, boil one hour, rinse quickly in water and then thoroughly three times.

PEARL.

1 per cent tetrazo sulphur black R. extra, 1 per cent sulphide soda conc., 2 per cent sal soda, 10 per cent common salt; rinse well quickly in water, and then thoroughly three times.

STEEL.

1 per cent tetrazo sulphur black Ex., 1 ounce tetrazo sulphur brown G., 1 per cent sulphide soda conc., 10 per cent common salt; rinse well quickly in water, and then thoroughly three times.

LIGHT GREEN.

1 per cent new methylene blue GG., ½ per cent thioflavine T., extra; enter at 120 degrees F. and get up to 160 degrees F. in 30 minutes, and turn five or six times and wash. To be dyed or yarn mordanted with tannic acid and tartar emetic.

TAN.

2 per cent tetrazo sulphur bronze, 2 per cent tetrazo sulphur brown G., 4 per cent sulphide soda conc., 3 per cent sal soda, 30 per cent common salt; enter at boil, boil one hour and wash well in three waters.

ECRU.

1 per cent tetrazo sulphur bronze, ¼ per cent tetrazo sulphur brown G., 1 per cent sulphide soda conc., 3 per cent sal soda, 20 per cent common salt; enter at boil, boil one hour, wash well in three waters.

RED.

4 per cent benzo fast red GL., 20 per cent Glauber's salt, 2 per cent sal soda, enter at 150 degrees F., give six turns to 180 degrees F., wash well in water.

PINK.

½ per cent diamond Rose GD., 2 per cent sal soda, 25 per cent Glauber's salt; enter at boil, boil one hour, and wash in water.

MEDIUM BLUE.

6 per cent pyrogene Indigo blue, 5 per cent sodium sulphide, 3 per cent

soda ash, 25 per cent Glauber's salt; enter at boil, boil one hour, and wash well in water.

SKY BLUE.

2½ per cent immedial sky blue, 3 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's salt; enter at boil, boil one hour; wash well in water.

DARK GREEN.

10 per cent pyrogene green B., 3 per cent pyrogene yellow M., 13 per cent sodium sulphide, 4 per cent soda ash, 30 per cent Glauber's salt; enter at boil, boil one hour; wash well in four waters.

Finishing Particulars.

Starch with eight ounces cornstarch, six ounces white cocoanut oil softening, one gallon water, boil one hour; dry over stenter frame and calender.

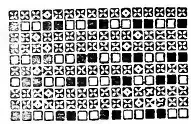
CORDUROY

Corduroy is a narrow, all-cotton fabric, the distinguishing feature of which is the perfect half-round regular ribs running warp ways through the cloth. As a fabric, it belongs to the general class of filling pile fabrics, and is made of one system of warp and two of filling. The warp must be of good cotton staple to make a fine strong end. The pile filling should be of first-class cotton, soft spun, to blend more readily when the ribs are rubbed after being cut and brushed.

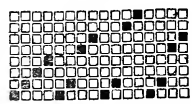
The warp and ground filling is woven either $\frac{1}{1}$, $\frac{2}{1}$ or $\frac{2}{2}$ twill, the pile pick weaves with either one, two or three warp end, and floats over from three to 12 warp ends. The length of the float of pile filling depends upon the width of rib or cord desired in the fabric. The important point about the pile weave is to cause the pile filling to weave with the same two or three warp threads. This gives us lines of binding and lines of filling floats running warp ways.

The velvety ribs or cords, as noted upon the face of a corduroy, are created by first cutting the lines of floats of the pile filling. This operation is performed by hand or machine with a very sharp steel knife, after which the ends of the floats are carefully brushed, and then rubbed together to the proper degree of consistency desired in ribs.

Corduroy is woven with from 160 to 500 picks of filling per inch; and is afterward dyed in dark blue, tan, buff, green and olive colors, to be used in making clothing for men or women.

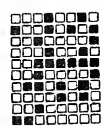


Design.



Drawing-in Draft.

Reed Plan.



Chain Draft.

Ground Weave $\frac{2}{2}$ twill.

☒ Means floats of Pile Filling.

☐ Means sinking of Pile Filling under the warp for the purpose of binding in.

It is also used for upholstery purposes, either in plain, solid colors or the plain color has an elaborate floral design printed upon it. These printed patterns are usually in bright colors, such as red, yellow, light green.

IN PRINTING,

the design is first engraved upon a set of copper rollers. These are set into a regular machine, and as the cloth passes over them, the color being fed to the rollers automatically, the design is placed upon the face of the cloth.

It is woven so as to finish from 27 to 31½ inches, the 27-inch for clothing and 31½-inch for upholstery.

This fabric requires a loom to be in good condition, as the beating in of such a high number of picks per inch of filling is hard on the loom, and also necessitates slow production.

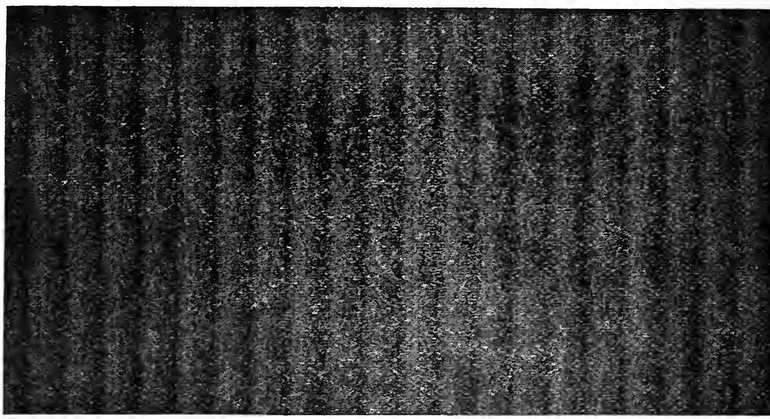
It is usually woven on dobby or cam loom, having single or double box.

Weaves are usually $\frac{1}{1}$ or $\frac{2}{1}$ or $\frac{2}{2}$

Filling, 1 ground, 1 pile, 1 ground, 2 pile, or 1 ground, 2 pile, 1 ground, 1 pile, this to be woven in a pick and pick loom.

Finish—Woven in the gray and dyed in the piece.

Four square inches equal 21.2 grains. Finished width, 31 inches, equals 13.51 ounces.



Corduroy.

48 ends per inch 2-28s cotton warp.
160 picks per inch 1-24s cotton ground filling.
240 picks per inch 1-20s cotton pile filling.

The above equals finished cloth.

Twenty pieces warp yarn, two inches, equals 40 inches equals .65 grains; 40 x 7,000 equals 280,000 divided by .65 equals 430,769, equals 11,-965.8 divided by 840 equals 14.24 or 2-28s cotton warp yarn.

Eighty pieces ground filling, two inches equals 160 inches equals 1.55 grains; 160 x 7,000 equals 1,120,000, divided by 1.55 equals 722,580, divided by 36 equals 20,071.66, divided by 840 equals 23.89 or 1-24s cotton ground filling.

Weight of pile filling per one-half inch finished cloth two inches wide, equals 2.6 grains.

2.6 grains x 15½ equals 40.32x72 equals 3,097.5 grains divided by 437.5 equals 7.08 ounces. Pile filling per yard, cloth 31 inches wide.

Forty-eight ends per inch finished times 31 inches equals 1,488 yards plus 10 per cent take-up in weaving equals 1,653 yards of 2-28s cotton warp equals 2.249 ounces.

160 ground picks times 31 equals 4,960 yards of 1-24s cotton filling equals 3.936 ounces.

240 picks times 31 equals 7,440 yards of 1-20s cotton pile filling equals 7.08 ounces.

7,440 yards times 16 equals 119,040 yards divided by 840, equals 1,417, divided by 7.08 equals 1-20s pile filling.

CONSTRUCTION.

36 ends per inch in reed; 38¾ inches wide, 10 per cent take-up; 25 per cent contraction in width from reed to finished fabric; 18 per cent increase in weight in dyeing.

COLOR—DARK GREEN.

To be used for upholstery purposes.

$\frac{2}{2}$ twill weave.

Filling: 1 ground pick, 2 pile pick, 1 ground pick, 1 pile pick.

Carding and Spinning Particulars.

Yarn suitable for making corduroy is made in the second division of mills, given in a previous lesson. The raw stock used should be of a good grade cotton of about 1 inch staple. The mixings should be as large as possible for reasons already stated in previous lessons. One large group of mills, which make this class of goods, use a somewhat different machine for opening up the raw cotton from that which has been described, and instead of using an opener after the cotton is put through the bale breaker, it is fed to a machine called

THE WILLOW.

The cotton is fed into the machine in small lots and the machine pulls it apart and thoroughly airs it. Some overseers claim that this machine treats the cotton to a more thorough airing than when an opener is used. It is again claimed that, in consequence of this fact, the cotton may be used right from the bale or mixed at this machine. It is an English machine, and while this system is used to some extent in England, it is the general custom to use the opener in this country. Good sliver waste from the cards and drawing frames is used in the mixing, as is also the sliver and lap waste from the comber room, when the mill is equipped with combers.

TWO PROCESSES OF PICKERS

are used with either a willow or an opener. Cut-roving waste is used and is mixed in at the finisher picker in the way that has been described in a previous lesson. If an opener is used, the speed of the beater should be about 1,000 to 1,100 revolutions per minute, with a speed of the fan about 350 revolutions per minute. The speed of the beater at the breaker picker should be about 1,500 revolutions per minute, and the speed of the fan about 1,400 revolutions per minute. A good weight for the lap made at the breaker picker is 40 pounds, while a good weight per yard of lap is 16 ounces. At the finisher picker the speed of the beater should be 1,450 revolutions per minute for a two-bladed beater, or 9.50 revolutions per minute for a three-bladed beater. The speed of the fan should be about 1,100 revolutions per minute with either beater.

A GOOD WEIGHT

for the lap would be about 38 pounds and the weight per yard 14 ounces. To get the grade of cotton used for this class of cloth clean, about 42 beats should be given to every inch of cotton fed at the back of the finisher picker. In other words, every inch of cotton should be struck 42 times before it is passed by the beater. With the above speed of the beater (1,450) this would be the number of blows that every inch of cotton received. Don't forget that it is very important to remove the fly from underneath the pickers at regular intervals during the day, because, if the fly is allowed to accumulate to any great extent, it might be drawn into the already cleaned cotton passing through the machine, and it is sometimes done, as all persons working around cards know, for they have seen at various times large patches of fly on the lap of cotton. This, of course, requires the card

TO DO EXTRA WORK

and clean and take out this dirt. It very often results in bringing up the feed roll or the licker-in of the card, if not noticed in time to remove the fly. It will be seen that it is important to keep the picker room clean at all times. It is very important to keep foreign matter, such as nails or pieces of metal, out of the cotton in the picker room, because of the liability of fires in the pickers, these being started by the foreign substance coming in contact with the quick moving beater blades and a spark being struck which ignites the cotton. This is apt to cause a bad fire if not promptly attended to. The

SETTINGS OF THE CARD

should be the same as given in a previous lesson on yarn, made in the second division of mills. The draft of the card should be about 100 to 125 for this class of cotton, the weight of the sliver at the front 65 grains to the yard; production, about 800 pounds per week of 60 hours. Three processes

of drawing are used, the weight at the finisher drawing being 70 grains per yard. The hank roving at the slubber should be about .55. The two-process fly frame is used, the hank at the first intermediate being 2, and at the second intermediate 6.00 hank roving. The rule for settings at these machines for this hank of roving has been given.

The spinning frame spins all the required counts for this hank roving, which, for the corduroy under description, is 20s, 24s and 28s, by changing the draft gear. The 28s yarn is then taken to the twister and doubled, so as to make 2-28s. A good sizing for the slasher for this class of goods is as follows: Water, 100 gallons; potato starch, 70 pounds; tallow, four pounds; turpentine, one pint.

Dyeing Particulars.

These goods are dyed at the jigger machine, a piece of 30 pounds being dyed. Care must be taken not to crush the pile.

One-dip colors are used for some goods, but, as the sulphur colors are so much improved, the bottom color is dyed with sulphur colors, and the goods topped with brighter aniline colors.

COLOR NO. 1—BLACK.

Blacks are sometimes dyed with a sulphur black as a bottom color. For 30 pounds of cloth (all of these colors are for 30 pounds of cloth); 15 gallons liquor, 3 pounds immedial black V. Ex., 2 pounds sodium sulphide, 3 pounds sal soda, 3 pounds common salt. Dissolve in separate tub, boil and strain through cotton cloth. Add to jig, in two portions, at first two ends. Run for 30 minutes at boil. Rinse in jig. After-treat with 1 pound bichromate potash, one-half pound sulphate iron. Rinse well and dye logwood black. Rinse well and top with a paint color as Prussian blue, or dye with a basic color.

ANOTHER BLACK.

Dye as color No. 1, with immedial black, and top with oxydiamine black AM., and rinse. Top with basic color or paint with Prussian blue.

DARK BLUE.

2-4 pounds immedial blue C., 2-4 pounds sulphide sodium, 3 pounds soda ash, 3 pounds common salt at 175 degrees F. Run 30 minutes. After-treat, cold 15 gallons liquor, 4 pounds peroxide soda, 6 ounces ammonia. Run 20 minutes.

For further batches, half the amount of drugs will suffice. The color can be shaded up with basic colors.

TAN.

1 pound immedial brown B., 1 pound sodium sulphide, 2 pounds sal soda, 3 pounds common salt. Run at boil for 30 minutes. Top with Bismarck brown.

BUFF.

1 pound immedial bronze A., 2 ounces immedial yellow D., 2 pounds sodium sulphide, 2 pounds sal soda, 3 pounds common salt. Run at boil 30 minutes. Rinse and after-treat, 1 pound bichromate of potash.

PEARL.

3 ounces immedial black V. extra, 1 ounce immedial brown B., 1 pound sodium sulphide, 2 pounds sal soda, 2 pounds common salt. Run at boil 30 minutes. After-treat, ½ pound bichromate potash, ½ pound sulphate copper.

RED.

2 pounds diamine fast red F., 10 pounds Glauber's salt. Run one hour at boil. Rinse. After-treat, ½ pound fluoride chrome. Top with diamine scarlet or safranine.

GREEN.

1 pound immedial black V. extra, 2 pounds sodium sulphide, 2 pounds sal soda, 3 pounds common salt. Run 30 minutes at boil. Rinse. Top with solid green crystals O.

LIGHT GREEN.

½ pound katigen chrome blue 5G., 1 pound sodium sulphide, 2 pounds sal soda, 3 pounds common salt. Run 30 minutes at boil. Rinse. Top with auramine and green.

OLIVE.

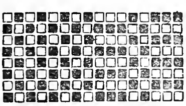
1 pound pyrogene olive N., 2 pounds sodium sulphide, 2 pounds sal soda, 3 pounds common salt. Run 30 minutes. Rinse. Top with auramine and Bismarck brown.

DARK BROWN.

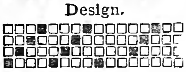
2 pounds sulphur brown, 4 ounces sulphur black, 3 pounds sodium sulphide, 3 pounds common salt. Run 30 minutes. Rinse. Top with auramine green, Bismarck brown or paint a brown on top, or dye a catechu and chrome bottom, and top with the above brown.

DIMITY

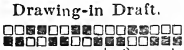
Dimity is a light-weight cotton wash fabric, the distinguishing feature of which is the cords or ribs running warpwise through the cloth, and produced by doubling the warp threads in either heddle or reed in sufficient quantity to form the rib desired.



Design.



Drawing-in Draft.



3 ends per heddle and dent.

Reed Plan.

Chain Draft.

Dimity is a ladies' summer dress fabric and is made of regular cotton yarn, from 1-60s to the very finest counts in both warp and filling, and is made in white and colors, solid white being used in the more expensive grades (warp and filling).

Dimity is made in ribbed stripe effects, and in such colors as ecru, pearl, light blue and blue. These colors are sometimes printed upon the face of the fabric, after it has been woven in the white.

Jacquard scroll and other figures are printed upon the white dimity to create elaborate patterns.

Dimity is always woven with a plain weave $\frac{1}{1}$, and by printing fancy floral designs upon the white surface of the cloth, that compactness of texture is retained which the plain weave alone can give. If, for instance, the floral effect were woven into the cloth, ends and picks remaining the same as for the plain weave, there would be created loose places warpwise of the cloth, due to the warp floats in forming figures.

Dimity, being a light-weight fabric composed of very fine yarns, is therefore best adapted to the lightest running looms. A plain or dobby loom would be the most suitable for this fabric; one capable of weaving from two beams, as these are usually woven.

Dimity is made in grades having from 64 ends and picks per inch to 100 and more ends and picks per inch, the count of the yarn varying in accordance with the degree of texture desired.

Dimity as a dress fabric has a rather soft feel, and so receives but very slight amount of starch in finishing, which process includes washing, bleaching, drying and calendering the goods, which are afterward rolled or lapped into bolts, "each cut or piece constituting a bolt." Each bolt or piece is then folded, the paper bands put on, and the goods are ready to pack and ship.

Construction.

One square inch equals .6 grain.

28½x36 equals 1,026x6 equals 615.6 divided by 1 square inch equals 615.6 divided by 437.5 equals 1.407 ounces per yard; 28½ inches wide finished.

40 pieces white warp yarn x 1¼ inches equals 50 inches equals .16 grains; 50x7,000 equals 350,000 divided by 1-6 equals 2,187,500, divided by 36 equals 60,762, divided by 840 equals 1-76s cotton warp.

35 pieces white filling yarn x 1½ inches equals 52½ inches equals 1.6 grains 52½x7,000 equals 367,500 divided by .16 equals 2,296,875 divided by 36 equals 63,691 divided by 840 equals 1-76s cotton filling.

28½ inches wide finished, 106 ends per inch finished, 84 picks per inch finished, equals 29 3-5 inches in reed, 100 ends per inch, 80 picks per inch loom.

1,800 reed—2 ends per dent (ground), cord—3 ends per dent and heddle, 5 per cent take-up in weaving.

3,021 ends plus 5 per cent equals 3,180 yards 1-72s cotton warp equals .841 ounces, 84 picks times 28½ inches equals 2,394 yards 1-76s cotton filling equals .6 ounces, total 1.441 ounces; 1.441 ounces per yard finished.

Carding and Spinning Particulars.

Dimity, or rather the counts of yarn required to make this style of cloth, requires first-class machinery, and it is, therefore, made in the third division of mills as given in a previous article. The grade and length of staple of the cotton used varies with the weight per yard of the cloth being made and may be composed of 1½-inch Allen cotton to 2-inch Sea Island cotton. For this lesson we will consider the counts to be 80s and the cotton used to be 1½-inch Sea Island. The mixings should be large and cotton allowed to dry out before being worked. As Sea Island cotton is comparatively a clean cotton it

REQUIRES LESS CLEANING

than other cottons, and another reason for putting it through less processes in the picker room is because of its length. If run through too many beaters the cotton is apt to be filled with neps. For Sea Island cotton of medium to long staple, i. e., from 1½ to 2¼ inches, it is better to use only opener and one process of picking, as compared with two processes of picking for other grades of cotton. The speed should not exceed 1,000 revolutions per minute, for a rigid two-bladed beater. This gives the cotton passing through the finisher picker about 29 blows or beats per inch. The laps should not be as heavy as when lower grades of cotton are used and a good weight of lap at the finisher picker is 30 pounds or 10 ounces to the yard. The card setting points should be set as close as possible, with the exception of the feed plate to the licker-in. The space between these two parts should be increased to the correct length of the staple being used. The

DRAFT OF THE CARD

should be increased to 125 or even 150, the speed of the licker-in made slower by lagging the licker-in pulley to 10½ inches, the speed of the flats and of the beater should also be slower and at the finisher picker increased and the speed of the doffer slower. The production of the card for fine counts of Sea Island yarn should not exceed 350 pounds per week of 60 hours, the weight per yard at the card being 40 grains per yard. The stock is then passed to the comber room and is here passed through the sliver lap and the ribbon lap machines and from here to the comber. Generally speaking, 14 ends are doubled at the sliver lap machine and the weight of the lap at the front is about 230 grains. Six laps are put up at the ribbon lap machine and the

WEIGHT OF LAP DELIVERED

is about 200 grains per yard. In very fine work only five laps are put up at the ribbon lap machine. The comber used is what is termed a six-headed comber, and the draft of this machine is considerable. The amount of waste taken out at the comber is more than that taken out of all the rest of the card room combined and for the cotton under description is from 20 to 25 per cent. The weight of the sliver being delivered is about 34 grains and the production of a six-head comber making 85 nips per minute is about 240 pounds per week of 60 hours. The cotton is next put through two processes of drawing, the weight at the finisher drawing being 55 grains per yard. The slubber makes this sliver into a .80 hank roving.

THE HANK ROVING

at the first intermediate is 2.25; at the second intermediate 5.00 hank and

at the jack 18.00 hank. Care should be taken with the settings of the rolls at all the machines, and also the cotton in process should be kept as free from dirt and bunches as possible. Cleaners should be frequently picked so that the bunches gathered on them will not pass through into the cleaned cotton.

The cotton is next carried to the spinning room, some mills using ring frame yarn for both warp and filling and some mills using ring spinning for warp and mule spun yarn for filling. We will consider that the warp yarn is ring spun and the filling is ring spun. The doublings at the ring frame are 2 into 1 and the draft of the machine about 9 minus. It will be understood that

ONLY THE LATEST STYLES

of ring frames can spin 80s yarn, and to do it, it is desirable to have the guide rolls rotate so that the roving being drawn over them will not be broken. For 80s yarn a good gauge of spindle is 2¾ inches with a 1¼ diameter ring and a 4½-inch traverse. The size traveler to be used varies and the correct one is only found by experimenting, but a good foundation to work from is a 22-0 traveler. The standard warp twist is 4.50 x square root of count. The speed of the spindles should be 9,400 revolutions per minute and the production about .32 pounds per spindle per week.

The filling is made on the mule or frame, and all that need be said is that the twist is less only 3.25 x the square root of the counts being put in. A good size to use for slasher is as follows: Water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds; soap (white), 172 pounds; paraffin wax, 1 pound.

Dyeing Particulars.

PINK.

For 100 pounds of cloth, 1 ounce benzo fast pink 2BL., 10 per cent soap, 150 degrees F.

LIGHT SKY BLUE.

½ per cent immedial sky blue powder, 1 per cent sodium sulphide, 1 per cent soda ash, 10 per cent Glauber's salt; wash well and top with 1 ounce Methylene blue O. O.

LIGHT GREEN.

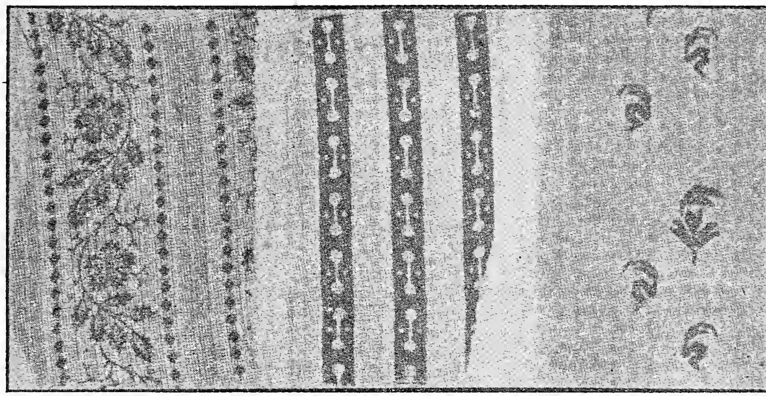
4 ounces brilliant benzo green B, ½ ounce chrysophenine, 10 per cent soap, 150 degrees F.

PEARL.

4 ounces immedial black NRT, ½ per cent sulphide sodium, ½ per cent soda ash, 2 per cent Glauber's salt.

GRAY.

4 per cent immedial black NRT, ¼



Samples of Dimity.

ounce immedial olive B, ½ per cent sulphide soda, ½ per cent soda ash, 2 per cent Glauber's salt.

LIGHT SLATE.

½ pound immedial direct blue B, ¼ ounce immedial olive B, ½ pound sulphide soda, ½ pound soda ash, 2 per cent Glauber's salt.

SLATE.

1½ per cent immedial black NRT, 1½ per cent immedial direct blue B, 3 per cent sodium sulphide, 1 per cent soda ash, 10 per cent Glauber's salt.

ECRU.

½ per cent immedial bronze A, ⅛ ounce immedial yellow D, 1 pound sodium sulphide, 1 pound soda ash, 10 pounds Glauber's salt.

LIGHT TAN.

½ per cent immedial cutch G, ½ per cent immedial orange C, 1 per cent sodium sulphide, 1 per cent soda ash, 10 per cent Glauber's salt.

NAVY BLUE.

3½ per cent immedial indone B, 2½ per cent immedial direct blue B, 5 per cent sodium sulphide, 2 per cent soda ash, 20 per cent Glauber's salt.

SCARLET.

5 per cent benzo fast scarlet 8 BS, 30 per cent Glauber's salt, 2 per cent soda ash.

SALMON.

4 per cent benzo fast orange S, 1 ounce benzo fast scarlet 8 BS, 10 per cent Glauber's salt. ½ per cent soda ash.

MAUVE.

4 ounces benzo fast violet R, 2 ounces benzo fast blue BN, 10 per cent Glauber's salt, ½ per cent soda ash.

Finishing Particulars.

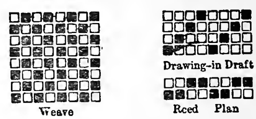
Mix up cold ½ pound white German dextrine, 1 gallon water, boil one hour, and starch through mangle and dry over tenter frame.

CHAMBRAY

Chambray is a light-weight, single cloth fabric, that is always woven with a plain weave and always has a white selvage. It is a staple fabric of many years' standing, being next in the line of cotton goods after the better grades of gingham. In effect it is a cloth having but one color in the warp, and woven with a white filling, this combination producing a solid color effect, the white filling having the chance of reducing any harshness of warp color in the cloth.

COMPOSITION.

Chambray is composed of one warp and one filling, either all cotton, cot-



ton and silk, or all silk. It is made 27 to 30 inches in width and of 1-30s cotton warp to 1-60s silk, the count of yarn being governed by the weight per yard desired. The weight per finished yard is 2 to 3½ ounces.

GOOD COLORS

for the warp are navy blue, dark brown, pink, lavender, black, nile green, etc.

This fabric is woven on any and all plain looms that will weave other light-weight cloths, the lightest running looms being the best on account of being easier on the fine warp yarns employed.

Chambray, when made of cotton warp and filling, receives a regular gingham finish, and the loom width can be restored to the goods during the finishing by the process of tentering.

TENTERING

means the running of the goods over a machine, fitted underneath with a series of coils of steam pipe; the top of the machine is fitted with an endless chain (on either side). This chain has a row of steel needles standing erect upon its face.

These chains are adjustable. This permits of altering the space between the chains, the idea being to set the chain the width desired, and as the machine runs, pass the needles through either selvage, and the cloth is stretched to the width desired.

To finish chambray, first run through the sprinkler, then through a solution of warm size, to stiffen the fabric. After the sizing the goods are tentered, to widen and partly dry them, then run through the cylinder to complete drying and last the calender to remove wrinkles, and to produce smooth, evenly ironed finish.

1 square inch equals 1.23 grains.

27x36 equals 973x1.23 equals 1,195.56 divided by 1 equals 1,195.56 divided by 437.5 equals 2.736 ounces per yard.

27 inches wide finished.

15 pieces light blue warp yarn x 4 inches equals 60 inches equals .58 grains—6 per cent weight size equals .5452 grains—15 per cent take-up equals .4635 grains.

60x7,000 equals 420,000 divided by .4635 equals 906,148 divided by 36 equals 25,176 divided by 840 equals 1-30s warp.

30 pieces white filling yarn x 2 inches equals 60 inches equals .55 grains.

60x7,000 equals 420,000 divided by .55 equals 763,636 divided by 36 equals 21,214 divided by 840 equals 1-36s filling.

78 ends per inch finished and 60 picks per inch finished equals 72 ends in reed per inch and 56 picks in loom per inch.

6 per cent size on warp; 15 per cent take-up on warp; weaving.

1,300 reed, 2 ends per dent.

27 inches wide finished including selvage.

78 ends x 27 inches equals 2,106 plus 32 ends white selvage equals 2,138.

Reed Plan.

2,106 blue ends + 15% take-up = 2,477.65 yards 1-30s warp..... =	1.573 oz.
32 white ends + 15% take-up = 37.65 yards 1-30s selvage...... =	.023 oz.
60 picks per inch × 27 inches = 1,620 yards 1-26s white filling. =	1.186 oz.
	2.782 oz.

2.782 ounces per yard.

Carding and Spinning Particulars.

The required machines, etc., to make chambray belong to the second division of mills as given in a previous lesson. For this class of goods a 1 to 1$\frac{1}{16}$ inch staple American cotton may be used. Mixings should be large, so that the yarn will always be as uniform as possible. After being run through the bale breaker, the cotton should be passed through an opener and two processes of picking. The usual points that have already been given in connection with the picker room should be looked after and need not be repeated here. The speed of the beater on opener is 1,050 revolutions per minute, fan 350 revolutions per minute, and be sure to keep hopper on this machine at least three-fourths full of cotton all the time that the machine is working. The speed of a two-bladed rigid beater at the breaker is 1,500 revolutions per minute and the speed of the fan 1,400 revolutions per minute. The lap at this machine weighs 16 ounces to the yard or about 40 pounds for the total weight of lap.

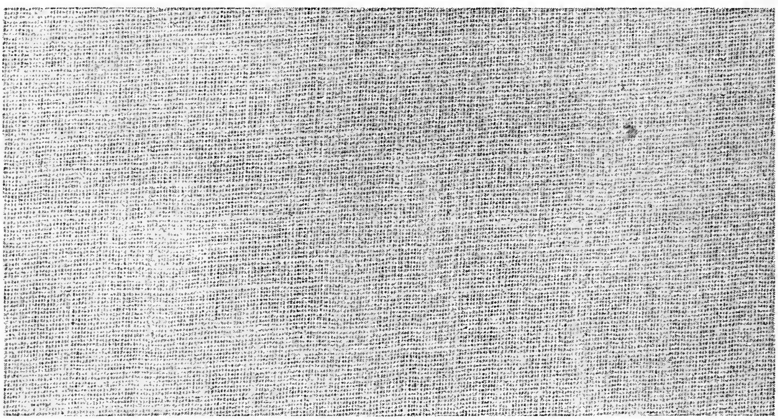
The speed of the beater at the finisher should be about 1,450 revolutions per minute and the fan 1,100 revolutions per minute, the weight of the lap 14 ounces, the total weight of the lap being 39 pounds. Cut-roving waste is mixed in with the good waste at the finisher picker as usual. The settings of the card should be about as given in a previous lesson when the settings for mills making medium counts of yarn were given in detail. The draft of the card should be about 100 and the speed of the licker-in 300 revolutions per minute. The wire used should be No. 34 on cylinder and 35 on doffer and flats. The cards should be ground at least once a month and stripped three times a day, for this class of goods. The weight per yard of sliver should be about 65 grains and the production per week 750 pounds. The cards should be cleaned thoroughly at least twice a day and the fronts should be cleaned at least twice more; the strips should be connected four times a day at regular intervals, for if this is not done the strips are apt to get under the stripping comb and onto

the flats, thus bringing up the comb and wire onto the flats. The flats should be ground at least once a month and a great deal of care should be taken with the setting of the grinding roll., because if this roll is set heavier on one side than on the other the cotton will not be evenly carded.

THREE PROCESSES OF DRAWING.

Three processes of drawing are used for this class of goods, the speed of the front roll being 400 revolutions per minute and the weight of the sliver at the finisher drawing should be 72 grains per yard. Production for 60 hours, 1,620 pounds per head per week. A good setting for the rolls for 1 1-16-inch staple would be as follows: 1 3-16 inches between front and second rolls, 1 5-16 inches between second and third rolls and 1 7-16 inches between third and back rolls. The slubber rolls are read as follows: Front roll to middle roll 1 3-16 inches; middle to back roll 1 5-16 inches. The slubber makes the sliver into a .55 hank roving. The hank roving at the first intermediate is 2.00 and fine frame 6.00 hank. Keep the bunches out of the roving as much as possible and change the top leather rolls frequently. Watch all your frames to see that no one frame is making too much bad work either by a poor hand or through the machine not being properly regulated. The 6.00 hank roving is taken to the spinning room and spun into 30s yarn. To do this, the following is given as the best equipped frame: For filling for 30s yarn most any high-grade spindle may be used and good results obtained; gauge of frame 2¾ inches; diameter of ring 1⅝ inches; length of traverse 6 inches and twist per inch 19.17. For 30s warp yarn, gauge of frame 2¾ inches; diameter of ring 1⅝ inches; length of traverse 6½ inches; twist per inch 26.02.

A good size that may be used at the slasher for this class of goods is as follows: Water, 100 gallons; corn starch, 50 pounds; tallow, 3 pounds; turpentine, 1 gill; boil 30 minutes.



Chambray.

Dyeing Particulars.

RED.

3½ per cent benzo fast red G L; 1 per cent chrysophenine; 30 per cent Glauber's; 2 per cent sal soda.

LAVENDER.

¼ per cent benzo fast violet R; 2 ounces benzo fast blue B N; 30 per cent Glauber's; 2 per cent sal soda.

NILE GREEN.

5 per cent katigen green 2 B; 5 per cent sulphide sodium; 2 per cent soda; 20 per cent Glauber's.

PINK.

5 per cent diamine rose B D; 30 per cent Glauber's; 2 per cent sal soda.

OLIVE.

3 per cent immedial olive B; ½ per cent immedial black N B; 1 per cent immedial brown B; 30 per cent Glauber's; 4 per cent sodium sulphide; 2 per cent soda.

BLACK.

15 per cent immedial black N N; 15 per cent sulphide sodium; 30 per cent Glauber's; 3 per cent soda.

NAVY BLUE.

4 per cent immedial indone B; 5 per cent immedial indone R; 9 per cent sodium sulphide; 30 per cent Glauber's; 3 per cent soda.

DARK BROWN.

15 per cent tetrazo sulphur brown B; 1 per cent tetrazo sulphur black; 16 per cent sodium sulphide; 30 per cent Glauber's salt; 3 per cent soda.

DARK SLATE.

2 per cent immedial black N B; 2 per cent immedial direct blue B; ¼ per cent immedial yellow D; 30 per cent Glauber's salt; 3 per cent soda; 5 per cent sulphide soda.

DARK GREEN.

8 per cent immedial dark green B; 1 per cent immedial yellow D; 10 per cent sodium sulphide; 30 per cent Glauber's; 3 per cent soda.

LIGHT BROWN.

3 per cent thion brown G; 3 per cent sodium sulphide; 1 per cent soda; 20 per cent Glauber's.

Finishing Particulars.

STARCH.

¾ pound corn starch; 1 gallon water, mix cold, and boil ½ hour; dry on cans and give a light calender.

CANTON FLANNEL

Canton flannel is a narrow, heavy all-cotton fabric, having a twill effect on one side of the cloth and a long, soft nap on the other side. It is always made with one warp and one filling. The weave generally is a $\frac{1}{3}$ twill for the winter weights, and $\frac{1}{2}$ twill for summer weight. The warp is composed of regular cotton yarns to which a very small percentage of size has been added, say 2 or 3 per cent, just sufficient to allow the yarn to withstand the operation of weaving. The filling is spun from a good grade of cotton, and is made with a slack twist to enable it to nap more readily, as this portion of the cloth is that which gives the fabric its one distinguishing feature.

THE TWILL WEAVE

is used in the construction of this fabric, because it permits of long regular floats in the filling effect of the weave, and these floats present an excellent surface from which to raise a nap. The other side of the cloth, being the warp effect of the twill weave, serves to create the diagonal rib or twill lines.

These goods are made to sell at 27 to 30 inches in width, at about 5¼ ounces, winter weight, composed of 1-10s to 1-6s warp and filling; also 3¼ ounces, summer weight, composed of 1-20s to 1-14s warp and filling, the heavy, coarse yarn in each instance being the filling.

Canton flannel can be woven on any single box-plain loom.

Summer weight three ounces.

Winter weight five ounces.

The nap is raised on the cloth by running the goods through a machine built especially for this purpose. The machine consists of an iron frame having a series of rollers set within it, and over these rollers the cloth passes The napping itself is done by a roller similar to a fancy on a woolen card. The cloth in passing over the wooden rollers at length passes between the wire toothed roller and a wooden roller. The cloth is being drawn through the machine automatically in one direction, and the wire-toothed roller revolves in the opposite direction, and being set for a nap of desired height

or loftiness, the wire, coming in contact with the soft filling yarn, brushes the fibre in such a manner as to cause it to stand out from the body of the filling thread, hence the nap.

Canton flannel is taken direct from the loom, measured, napped and folded; then is ready to pack and ship.

4 square inches equals 9.25 grains. 27¼ inches selling width. 27¼ x 36 equals 981 x 9.25 equals 9,074.25 divided by 4 equals 2,268.56 divided by 437.5 equals 5.185 ounces per yard. 27¼ inches finished.

15 pieces warp x 3 inches equals 45 inches equals 1.14 grains.

45 x 7,000 equals 315,000 divided by 1.14 equals 276,315.78 divided by 36 equals 7,675.44 divided by 840 equals 9.14 or 1-10s cotton warp.

8 pieces filling x 5 inches equals 40 inches equals 1.18 grains.

40 x 7,000 equals 280,000 divided by 1.18 equals 237,288.13 divided by 36 equals 6,591.33 divided by 840 equals 7.84 or 1-8s cotton filling.

CONSTRUCTION.

Reed 540—30 3-5 inches, including selvage of 32 ends, 4 ends per dent. 5 per cent take-up in weaving.

68 ends per inch finished and 48 picks per inch finished equals 60 ends per inch in loom and 44 picks per inch in loom. $\frac{3}{1}$ 45s twill weave. 1-10s cotton warp. 1-8s cotton filling.

68 ends per inch x 27 equals 1,836 plus 32 equals 1,868 ends plus 5 per cent take-up equals 1,956 yards of 1-10s cotton warp equals 3.725 ounces.

48 picks x 27¼ equals 1,308 yards. 1-8s cotton filling equals 3.114 ounces.

3.725	ounces warp.
3.114	ounces filling.
6.839	ounces from loom.
6.839	ounces loom.
5.185	ounces finished.
1.654	ounces loss in napping.

Carding and Spinning Particulars.

Canton flannel, or rather the counts of yarns to make this class of cloth, consists of a low grade of cotton of about three-fourths to one inch in staple, and the mills making Canton flannel belong to the first division of mills. The bales of raw stock are not sorted out as carefully as is the custom when fine yarns are to be made, but all the bales should be stamped to get the length of staple as near uniform as possible. Larger mixings are used for this class of goods than when fine goods are being made, because more cotton is used, due to a larger production being turned off at each process. The cotton is sometimes passed through a bale breaker, but more often is

MIXED BY HAND,

i. e., taken from the bale and broken into small bunches and thrown directly into the mixing bin. The cotton is allowed to stand as long as possible to dry out and is then put through the opener. In some mills the waste from the comber and card is put into the mixings in very small proportions, but more generally only the good waste is put in. The speed of the beater should be 1,050 revolutions per minute, it being remembered that the lower grades of cotton are dirtier than the higher grades and longer stapled cotton. It may seem strange to some of our readers that the speed of the beater of the opener is 1,050 revolutions per minute for both low, medium and even high grades of cotton, but it must be remembered that the staples of the cottons differ and the speed of the beater really is based on so many blows or beats per minute; so that cotton having a staple of three-fourths of an inch receives twice as many beats per inch as cotton one and one-half inches in length, all other conditions remaining the same. The above not only applies to the beaters on the openers, but also to all the pickers. In these lessons it is taken for granted that a two-bladed beater of the ridged type is used, and for a three-bladed beater, the speed should be less, or as two is to three. Special speeds should be used for other makes of beaters, such as the vertical, porcupine and Kirschner beaters. Two processes of picking are used. The weight per yard of lap is 40 pounds or 16 ounces to the yard. The speed of the finisher beater is 1,450 revolutions per minute, and the finished lap weighs 39 pounds or 14½ ounces to

the yard. The bars under the beaters should not be too close together, so that the dirt and foreign matter in the cotton cannot drop through into the waste receptacle after it has been separated from the cotton, and the dirt, etc., should be thus removed at regular intervals, so as not to choke these beater bars and thus allow the dirt to pass through with the good cotton. This class of goods should be carded on coarse wire. The

DRAFT OF THE CARD

should not exceed 100, and a draft of 90 is much better, as the stock will be handled better. The speed of the beater should be 300 revolutions per minute and a 26-inch diameter doffer should be used when possible. The production of the card should be from 900 to 1,000 pounds of sliver per week of 60 hours. Two processes of drawing are used, the speed of the front roll at each being 400 revolutions per minute, the weight of the sliver at the finisher being 70 grains per yard, six ends being put up at the back. The hank roving made at the slubber should be about .50, or, say, .55. This is made into 1.00 hank at the first intermediate and into a 4.00 roving at the second intermediate. The 1.00 hank roving is spun into a soft twisted 6-count cotton yarn in the spinning room, and the 4.00 is made into 20s soft twist yarn. A warp frame to make 6s should have the following particulars: Gauge of frame 3 inches, diameter of ring 2¼ inches, length of traverse 7 inches, or even more than this length may be used. For a filling frame for 20s, use 2¾-inch gauge of frame, 1½-inch diameter of ring and 6½ inches length of traverse. Remember that this class of goods requires a soft twist.

Dyeing Particulars.

The pieces are run through the napping machines and the fibre well raised, before the dyeing operation.

The pieces are dyed in the jig machine, or continuous dyeing machine, where the pieces are run over rollers, 6-10 times through the dyeing liquor, and then passed through two squeeze rollers. In the continuous machine the nap is not laid as much as in the jig.

The colors generally dyed are one dip direct colors, bright shades being mostly called for.

LIGHT BLUE.

One per cent tetrazo sky blue; 20 per cent Glauber's; 1 per cent sal soda.

LIGHT BROWN.

Two per cent tetrazo brown B.; ½ per cent tetrazo yellow D.; 25 per cent Glauber's; 1 per cent sal soda.

PINK.

One-half per cent diamine rose BD.; 15 per cent Glauber's; 1 per cent sal soda.

RED.

Four per cent benzo purpurine 4 B.; 30 per cent Glauber's; 3 per cent sal soda.

HELIOTROPE.

One-half per cent benzo fast violet R.; ¼ per cent benzo fast blue BN.; 20 per cent Glauber's; 2 per cent sal soda.

GREEN.

Three per cent diamine green G.; ½ per cent diamine fast yellow B.; 30 per cent Glauber's; 3 per cent sal soda.

SCARLET.

Four per cent diamine scarlet B.; 30 per cent Glauber's; 3 per cent sal soda.

OLIVE.

Two per cent benzo dark green GG.; 2 per cent chrysophenine; 30 per cent Glauber's; 3 per cent sal soda.

ORANGE.

Two per cent benzo fast orange S.; 30 per cent Glauber's; 3 per cent sal soda.

BLUE.

Four per cent diamine brilliant blue G.; 30 per cent Glauber's; 3 per cent sal soda.

ECRU.

One-quarter per cent immedial yellow D.; ¼ per cent immedial cutch G.; 2 per cent sodium sulphide; 2 per cent soda; 20 per cent Glauber's salt.

SLATE.

One-half per cent benzo fast black; ½ per cent benzo fast blue BN.; 30 per cent Glauber's salt; 2 per cent sal soda.

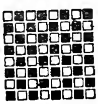
MAROON.

Three per cent diamine fast red F.; 1 per cent diamine bordeaux B.; 30 per cent Glauber's; 3 per cent sal soda.

When the pieces are dyed, well rinsed and dryed, they are run through the napping machine to finish the goods and raise the fibres.

DUCK

Duck is a heavy-weight, single cloth fabric, made from all-cotton yarns. But one warp and one filling are necessary, and these are usually of coarse, two-ply yarns woven into a



Design

Drawing-in Draft

Reed Plan

cloth having a high texture. Duck has a stiff, hard feel, which fact imparts to it the splendid wearing qualities for which it is popularly known as a staple material. It is used principally in the manufacture of sails, tents, car curtains, etc., or for any other purpose requiring a good water-tight fabric, which will withstand rough usage. Duck is made

IN A VARIETY OF GRADES

weighing from 7 ounces to the yard, 27 inches wide, to 25¼ ounces per yard, 60 inches wide. The lighter weights in this fabric are used extensively for awnings. These goods are either stripes or solid colors and are never plaided.

The majority of these goods are made all white.

Nearly all known textile colors are at times used in making color effects in this line, the most popular being dark brown and white, indigo blue and white, tan and white, tan and white twist and tan; all of which are fast colors.

Duck, being a hard, stiff fabric, caused by using coarse yarn at high texture, calls for a heavier loom than that used for an ordinary cloth. The duck loom was built for this very purpose, and is entirely satisfactory, as it is a plain, single box cam loom each part being heavier than its corresponding part in an ordinary light running plain loom.

Duck is made also in light weights for use as an outing trousering for men in solid black; also in pale blue, ecru, pink, etc., for ladies' shirtwaist suits.

To finish this fabric, it is taken from the loom and measured, then washed and sized, then dried and pressed.

If a fancy, solid color is desired, the goods are dyed in the piece after the first washing.

AWNING STRIPE DUCK 31" WIDE FINISHED.

Threads per inch, 50 finished.
Picks per inch, 34 finished.

$$\frac{61'' \times 7{,}000 \text{ grains}}{2.1 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 6.72 \text{ warp.}$$

Yarn is 2-ply, so it is 13.44/2 warp.

$$\frac{85'' \times 7{,}000 \text{ grains}}{1.85 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 10.64 \text{ filling.}$$

Warp shrinkage, from tests, 15%.
Filling shrinkage, from tests, 6%.
Reed width, 31" finished ÷ .94 = 33" wide in reed.
15½ reed × 33" width = 512 dents.
512 dents × 3 ends per dent = 1,536 ends in warp.
1,536 ends ÷ (6.72 × 840) = .2721, warp weight without take-up.
15% take-up in weaving.
.2721 ÷ .85 = .3201, total warp weight per yard of woven cloth.

$$\frac{34 \text{ picks} \times 33'' \text{ reed width} \times 36''}{36''} = 1{,}122 \text{ yds.}$$

of filling per yard of cloth.
1,122 ÷ (10.64 × 840) = .1255, total filling weight per yard of cloth.
.3201 + .1255 = .4456, total weight per yard.
.4456 × 16 oz. per lb. = 7.13 oz. per yard.

ARMY DUCK 28½" WIDE—10 OZ.

Threads per inch, 47 finished.
Picks per inch, 38 finished.

$$\frac{76'' \times 7{,}000 \text{ grains}}{3.8 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 4.63 \text{ warp.}$$

Yarn is 3-ply, so it is 13.89/3 warp.

$$\frac{100'' \times 7{,}000 \text{ grains}}{3.4 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 6.81 \text{ filling.}$$

Yarn is 2-ply, so it is 13.62/2 filling.
Warp shrinkage, from tests, 18%.
Filling shrinkage, from tests, 8%.
Reed width, 28½ ÷ .92 = 31" wide in reed.
14½ reed × 31" width = 450 dents.
450 dents × 3 ends per dent = 1,350 ends in warp.
1,350 ends ÷ (4.63 × 840) = .3470, warp weight without take-up.
18% take-up in weaving.
.3470 ÷ .82 = .4232, total warp weight per yard of cloth.

$$\frac{38 \text{ picks} \times 31'' \text{ reed width} \times 36''}{36''} = 1{,}178 \text{ yds.}$$

of filling per yard of cloth.
1,178 ÷ (6.81 × 840) = .2059, total filling weight per yard of cloth.
.4232 + .2059 = .6291, total weight per yard.
.6291 × 16 oz. per lb. = 10.06 oz. per yard.

HEAVY DUCK, 38" WIDE.

12 oz. at 28½" wide.
16 oz. at 38" wide.
21 oz. at 50" wide.
25¼ oz. at 60" wide.
Threads per inch, 44 finished.
Picks per inch, 32 finished.

$$\frac{78'' \times 7{,}000 \text{ grains}}{3.85 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 4.69 \text{ warp.}$$

Yarn is 3-ply, so it is 14.07/3 warp.

$$\frac{84'' \times 7{,}000 \text{ grains}}{5.5 \text{ grs.} \times 36'' \times 840 \text{ standard}} = 3.53 \text{ filling.}$$

Yarn is 4-ply, so it is 14.12/4 filling.
Warp shrinkage, from tests, 25%.
Filling shrinkage, from tests, 5%.
Reed width = 38" ÷ .95 = 40" wide in reed.
14 reed × 40" width = 560 dents.
560 dents × 3 ends per dent = 1,680 ends in warp.
1,680 ends ÷ (4.69 × 840) = .4264, warp weight without take-up.
25% take-up in weaving.
.4264 ÷ .75 = .5685, total weight of warp per yard of cloth.

$$\frac{32 \text{ picks} \times 40'' \text{ reed width} \times 36''}{36''} = 1{,}280 \text{ yds.}$$

of filling per yard of cloth.
1,280 ÷ (3.53 × 840) = .4317, total weight of filling per yard of cloth.
.5685 + .4317 = 1.0002, total weight per yard.
1.0002 × 16 oz. per lb. = 16.003 oz. per yard.

Carding and Spinning Particulars.

Duck is made from various grades of raw cotton, according to the use to which it is going to be applied. Even Sea Island cotton of the longest staple has been used to make duck cloth, but this is the exception rather than the rule. When the longer and higher grades of raw stock are employed, the cloth made is generally used for sail, and the Sea Island cotton was utilized to make into duck for one of the yachts which raced for the international cup. For the average use, however,

THE STOCK USED

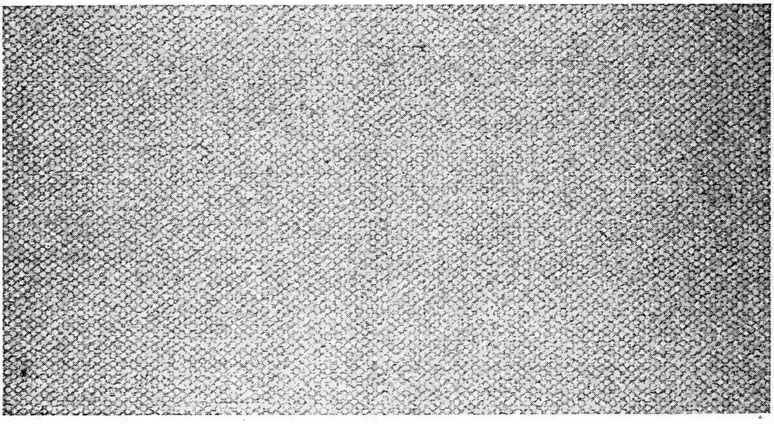
is of about one-inch staple and of a medium low grade of cotton. The class of mills making duck belongs to the first division of mills, as given in a previous lesson. The cotton is put through a bale breaker and from here is passed on to the mixing bin. At this bin good waste is mixed in, and sometimes, in the lower classes of ducking, comber and card waste are mixed in in small quantities. When waste is mixed with raw stock, it is mingled in certain fixed proportions, and should not be done in a haphazard way, because waste always makes the mixture give more or less trouble while in the earlier processes of handling than is the case when cotton is used by itself. The cotton, after being mixed, is allowed to stand as long as possible before using for reasons already given in previous lessons, and then is run through an opener and two processes of picks. As the lower grades of cotton are generally dirtier than the higher grades, a higher speed of the beater is required, so that the speed of the opener should be about 1,100 revolutions per minute while the speed of the breaker picker should be at least 1,500 revolutions per minute, and the speed of the beater of the finisher picker should be 1,450 revolutions per minute, or about 42 beats per inch of stock.

The lap at the breakers should weigh at least 40 pounds or 16 ounces to the yard, while at the finisher picker the lap should weigh 39 pounds or about 15 ounces to the yard. If waste is used in the mixture, generally a great deal of trouble is found from what is called licking, i. e., where the lap does not unroll as it should, but layers adhere to one another. If the lap is not fixed it will be seen that

UNEVEN YARN WILL RESULT.

There are various causes for laps licking, two of the principal ones being the presence of too much waste in the mixture, the remedy for which is obvious; and second, that the current of air in the picker is not properly directed so that the greater part, if not all, of the cotton, after it has passed the beater, is not blown as it should be onto the top cage, but the air is so directed that the cotton falls on both cages and a split in the lap is bound to occur and cause licking at the next process. Licking is always the cause of a great deal of trouble and should be stopped as quickly as possible. The lap is passed onto the card, which, for this class of goods, is provided with a heavy wire. The draft of the card should be about 90 to 100. The sliver

should weigh at least 65 grains to the yard and the production should be as large as possible, a good average ranging from 900 to 1,000 pounds per week. Cards should be stripped on this class of goods three times a day, and some overseers advocate four times a day, but this extra stripping is to be questioned as to advisability. The speed of the licker-in for this class of goods is 300 revolutions per minute. The cotton sliver is passed through three processes of drawing, the weight of the finished slivers being 70 grains. From here it is passed to the slubber and made into .55 hank roving. From here it is passed through the first intermediate and made into 1.10 hank and onto the second intermediate and made into 3.00 hank. From here it is passed to the spinning room. For awning stripes, this three-hank roving is made into 12s warp and 20s filling, and for coarser ducking into 12s warp and 18s filling. Good specifications for a filling ring frame are as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 6½ inches; and for a warp ring frame, gauge of frame, 3 inches; diameter of ring, 2⅛ inches; traverse, 7 inches. The yarn is then taken to the twister and doubled as required.



Duck.

Dyeing Particulars.

FOR AWNING DUCKS.

As the colors for this fabric must be as fast as possible to sunlight and rain, so the color will not fade or run into the white stripes, only absolutely fast colors are dyed. The yarn is generally dyed in the warp.

INDIGO BLUE.

Indigo blue has been dyed for these goods until recently, but immedial blues have been found to withstand exposure even better than indigo.

Four and one-half per cent immedial indone B.; 4½ per cent immedial indone R.; 9 per cent sulphide sodium; 3 per cent soda, and 30 per cent Glauber's.

TURKEY RED OIL.

(Time About 3 Days)

First, a thorough bleaching process.

Second, the material is worked in a bath of aluminum acetate 9 degrees Tw. This is a mordanting process. In place of the material named basic aluminum sulphate at 9 degrees Tw. can be used. The material is wrung out and dried at 120 degrees F. for 24 hours.

Third, material is worked until thoroughly impregnated in a bath made up of Turkey red oil and 9 parts water. It is then wrung out and dried

at 145 degrees F. for 12 hours.

Fourth, this process is the same as second.

Fifth, the material is now worked in a bath made up with one-half part calcium carbonate and 100 parts water. It is worked for about one-half hour at 95 degrees F., and then washed well in clean water.

Sixth, the material is now dyed in a bath containing from 6 to 15 per cent of alizarine (also 5 parts of lime, per 100,000 of water). The material is entered into bath cold, then worked for 20 minutes and the temperature is slowly raised to 145 degrees F. and the process continued for 1 hour. The material is then washed and the water extracted.

Seventh, this operation is the same as third.

Eighth, this process consists of steaming the material for 2 hours at 10 degrees pressure and then washing thoroughly.

Ninth, the material is boiled for about ¾ of an hour in a soap solution containing one part of soap in 200 parts of water. It is afterward dried and the process is completed.

BUFF.

Pass through solution 10 gallons water, one pint nitrate iron, 33 degrees Tw., squeeze, pass through solution 10 gallons water, one pint caustic soda, and rinse. Repeat operation until shade is dark enough; rinse well.

CHROME YELLOW.

Pass through solution 10 gallons water, one pound white sugar lead, squeeze, pass through solution 10 gallons water, one pound bichrome, four pounds common salt; rinse well.

CHROME ORANGE.

Pass through solution of sugar lead, 24 degrees Tw., squeeze. Pass through hot lime water, squeeze, chrome, two ounces to gallon boiling, squeeze; run through hot lime water and rinse.

LIGHT BROWN.

Four per cent immedial cutch C.; 4 per cent immedial brown B.; 8 per cent sulphide soda; 3 per cent soda; 30 per cent Glauber's; rinse, after-treated to make color much faster; 2 per cent blue stone; 2 per cent chrome; 3 per cent acetic acid; rinse and soap.

DARK BROWN.

Six per cent immedial cutch G.; 6 per cent immedial brown B.; ¼ per cent immedial black NR.; 10 per cent sulphide sodium; 3 per cent soda; 30 per cent Glauber's; rinse, after-treat: 2 per cent blue stone; 2 per cent chrome; 3 per cent acetic acid; rinse and soap.

MAROON.

Six per cent immedial maroon B.; 6 per cent sulphide sodium; 3 per cent soda; 30 per cent Glauber's; rinse, after-treat: 1 per cent blue stone; 1 per cent chrome; 3 per cent acetic acid; rinse and soap.

LIGHT GREEN.

Three per cent immedial indone B.; 2 per cent immedial yellow D.; 5 per cent sulphide sodium; 3 per cent soda; 25 per cent Glauber's; after-treat: 3 per cent blue stone; 3 per cent chrome; 3 per cent acetic acid.

DARK GREEN.

Eight per cent katigen indigo B.; 4 per cent katigen chrome brown 5 G.; 8 per cent sulphide sodium; 3 per cent soda; 25 per cent Glauber's; after-treat: 3 per cent blue stone; 3 per cent chrome; 3 per cent acetic acid; rinse and soap.

BLACK.

Fifteen per cent immedial black NN.; 13 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's; rinse, after-treat: 3 per cent blue stone; 3 per cent chrome; 3 per cent acetic acid; rinse and soap.

DARK SLATE.

Three per cent immedial black V. Ex.; 3 per cent sodium sulphide; 2 per cent soda; 20 per cent Glauber's; rinse, after-treat: 1 per cent blue stone; 1 per cent chrome; 2 per cent acetic acid; rinse and soap.

ARMY DUCK.

Army duck has been always dyed the old, reliable cutch and chrome brown. First, pass through a boiling solution of cutch logwood and fustic or cutch alone, and then through a solu-

tion of boiling chrome and sometimes a weak solution of nitrate of iron for after-treatment; rinse and soap.

Army duck can be dyed with sulphur colors: 5 per cent immedial cutch O.; 1 per cent immedial brown RR.; rinse and treat: 1½ per cent blue stone; 2 per cent chrome; rinse and soap.

STRIPES—HICKORY STRIPES

This is an all-cotton, light-weight fabric, averaging about five ounces per yard finished. In appearance it resembles ticking, although it is of lower texture and has a softer feel, due to the process of finishing. It is always woven with a $\frac{2}{1}$ regular 45 degrees right-hand twill (warp effect) and in two colors, blue and white or brown and white in the warp and all white filling, thus forming warp stripe patterns.

It is used in the rural mountain districts of a few of the middle and southern states as a material for men's pants and shirts, as these two garments constitute about all the clothing necessary in such sections for most all seasons of the year. It is

A TOUGH, PLIABLE FABRIC,

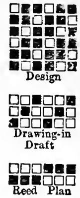
having good wearing qualities and on the principle of economy is well adapted to the needs of the poorer white laboring class of the South.

This fabric is made of regular cotton yarns, 1-14s and 1-16s warp and filling, and is woven to finish about 27 inches in width.

It can be woven on any plain loom, and is usually drawn in on cotton harness, as these are cheaper in the estimation of the southern cotton manufacturer, as he can use up old stock in the spinning of cotton harness cord, and in this manner, to a certain extent, create a by-product, as against the cost of equipping the plant with wire heddles and other necessary findings—harness rods, frames, etc.

To finish hickory stripe, the cloth is taken from the loom and measured, then it is sheared, sized and pressed, it is then rolled or lapped and is ready to pack and ship.

Four square inches equals 9.25 grain. 27x36 equals 972x92 equals 8,-



Design

Drawing-in Draft

Reed Plan

991.00 divided by 4 equals 2,247.75 divided by 437.5 equals 5.137 ounces per yard.

15 pieces blue warp yarn times 4 inches equals 60 inches equals one grain. 60x7,000 equals 420,000 divided by .1 equals 4,200,000 divided by 36 equals 116.666 divided by 840 equals 1-14s cotton. 15 pieces white warp yarn times 4 inches equals 60 inches equals .1 grain. 15 pieces white filling yarn times 4 inches equals 60 inches equals .9 grains. 60x7,000 equals 420,-000 divided by .9 equals 466,666 divid-

10% contraction in width in weaving.
5% take-up in length in weaving.
6 2-3% shrinkage in length in finishing.
6% size on warp.

WARP PATTERN.
6 Blue.
3 White.
3 Blue.
3 White.

15 ends per repeat.

ed by 36 equals 12,962.96 divided by 840 equals 1-14s cotton.

Reed 800—3 ends per dent, 30 inches in reed, including selvage, 27 inches finished. Filling—all white, 74 ends per inch finished and 60 picks per inch finished equals 66 ends per inch loom, 56 picks per inch loom.

74 ends per inch times 27 inches equals 1,998 ends plus 24 selvage equals 2,022 ends; 1,998 divided by 15 equals 133 repeats plus 3 ends.

9 blue ends per pattern times 133 equals 1,197 plus 3 equals 1,200 blue ends. 6 white ends per pattern times 133 equals 798 white ends, 24 white ends selvage.

1,200 blue ends + 5% take-up = 1,263 yards 1-14 cot..........=	1.718 oz.
798 white ends + 5% take-up = 840 yards 1-14 cot...........=	1.142 oz.
24 white selvage = 25.26 yards 1-14 cot. ....=	.034 oz.
56 picks white filling × 30 = 1,680 yards 1-14 cot................=	2,285 oz.
Per yard	5.179 oz.

Finish equals sizing and pressing weave $\frac{2}{1}$ warp effect 45 degrees twill.

Dyeing Particulars.

BLUE.

Dye in the warp—1½ per cent immedial indone 3B., 4 per cent immedial indone B., 4 per cent sodium sulphide, 3 per cent soda, 30 per cent Glauber's, rinse well.

DARK SLATE.

4 per cent immedial black NR., 4 per cent sodium sulphide, 3 per cent soda, 20 per cent Glauber's, rinse well.

BLACK.

1 per cent katigen black SW., 15 per cent sodium sulphide, 3 per cent soda, 30 per cent Glauber's, rinse well.

DARK BROWN.

15 per cent katigen brown V., 15 per cent sulphide sodium, 3 per cent soda, 30 per cent Glauber's, rinse well; starching, one gallon water, one-half pound cornstarch, mix cold, boil one hour, run through starch mangle and dry, give a light calendering.

TICKING

Ticking is a single cloth, of either medium or heavy weight, and is composed of single cotton yarns from 1-14s to 1-22s in warp and filling or combination of both, such as 18s warp and 20 filling. It is a good, stout cloth, having fine wearing qualities, and is used principally for making bed ticks and pillow and bolster cases. It is generally made with what is known as a bed-tick weave or $\frac{2}{1}$ or $\frac{3}{1}$ twill, either right or left handed 45s twill broken or herring-bone. It can be woven in any power loom, but is best adapted to and most always woven in the

PLAIN SINGLE BOX LOOMS.

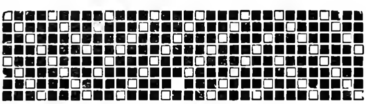
This fabric is quite often woven upon an automatic loom, and in the future it undoubtedly will be noted that more of these looms are being used for the making of ordinary fabrics of which ticking is one of the most staple. The reason automatic looms have an advantage on such cloths is that a much greater number of looms per weaver can be operated, and the cost for weaving be quite radically reduced. With simple weaves and medium or heavy yarns the automatic loom usually will show quite a little advantage.

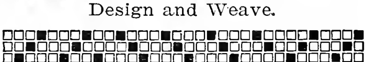
Ticking belongs to the family of stiff, hard faced cotton fabrics. This feature is created by using twill weaves (warp effect) and these weaves permit of the use of a more than ordinary high warp texture. For instance, take $\frac{3}{1}$ twill: In the weave there are interlacings of each warp thread in every four picks of filling, thus allowing ends to lie closely togeth r—hence permitting an increase in ends per inch.

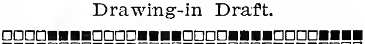
These goods are usually made in two colored warp patterns—dark blue and white, red and white.

WHITE FILLING USED WHOLLY.

Fast colors should be used in warp, as bed-ticks are sometimes ripped open and the cloth washed. In this case the light and air renew the coloring on the yarns.


Design and Weave.


Drawing-in Draft.


Reed Plan.

One feature which is worth mentioning in regard to ticking and other similar lines is that they are to-day being stock-dyed in increasing quantities. This method consists of dyeing the cotton, or bleaching it, as the case may be, in the raw state and then carding, drawing and spinning just as if a grey fabric were to be made. This results in decided savings in the cost of manufacture, and probably no new plant would be erected except on the

above basis. Certain of the fast colors which have been developed in recent years are most successful when the cotton is dyed in the raw state, and this fact, together with economy in manipulation, is the reason why stock-dyeing has been used. There is another advantage when coarse yarns are being dyed in the raw stock, for by this method the yarn is colored to the center, whereas in other methods penetration is seldom thorough.

Ticking is woven with from 60 to 84 ends and picks per inch in the loom, according to grade required. The greater the number of warp threads the stouter the fabric in proportion to counts of yarns used.

To finish these goods, they are brushed and sheared to remove all lumps and foreign substances from the face of the cloth. Then the cloth is sized and calendered, which acts in the same manner as a hot press, after which the cloth is lapped or rolled into bolts, then stitched, and is ready to pack and ship.

CONSTRUCTION OF TICKING.

Reed 725—33 inches, 4 ends per dent. 1-16s warp, 1-20s filling, 74 picks; 12½ per cent take-up in weaving; 10 per cent size on warp, 7 per cent size of cloth in finish; $\frac{3}{1}$ herring-bone twill weave; finish equals 31½ inches, and includes brushing, shearing, sizing and calendering.

WARP PATTERN.

16 White.
2 Blue.
2 White.
8 Blue.
2 White.
2 Blue.

1 square in. = 2.9 grains.

31½ times 36 equals 1,134 square inches times 2.9 equals 3,288.6 grains divided by 437.5 equals 7.51 ounces.

18 pieces warp yarn, 2 inches, equals 36 inches equals .55 grains; 36 x 7,000 equals 252,000 divided by .55 equals 45,818 divided by 36 equals 12,727 divided by 840 equals 1-16s warp yarn.

20 pieces filling yarn, 1½ inches, equals 30 inches equals .34 grains.

30 x 7,000 equals 210,000 divided by .34 equals 617,644 divided by 36 equals 17,156 divided by 840 equals 1-20s filling yarn.

92 ends per inch finished equals 86 in reed.

78 picks per inch finished equals 74 in loom.

92 x 31½ equals 2,898 plus 24 equals 2,922 ends.

1,473 ends white equals 12½ per cent take-up equals 1,683 yards.

1-16s cotton warp equals 2 ounces.

1,449 ends blue equals 12½ per cent take-up equals 1,656 yards.

1-16s cotton warp equals 1.97 ounces plus 22 per cent increase by dyeing equals 2.22 ounces.

White warp yarn equals 2 ounces plus blue warp yarn equals 4.22 ounces plus 10 per cent size equals 4.64 ounces.

78 picks x 31½ equals 2,457 yards 1-20s filling equals 2.34 ounces.

Warp weight equals 4.64 ounces plus filling weight equals 2.34 ounces plus 7 per cent size in finishing equals 7.50.

Carding and Spinning Particulars.

The yarns used in ticking are made in mills of the first division, as given in a previous article. The length of the raw stock used varies in different mills according to the grade of ticking to be made, but is generally ⅞ to 1⅛ inches in length. This does not mean that raw stock of from ⅞ to 1⅛ inches is used in the same mixing, but that the mixing is made up of stock of uniform length.

THE MIXINGS

for this class of goods are generally made by hand and the bins should be made as large as possible, so as to accommodate large mixings. It would be better to have two large bins instead of one, so that one lot of raw stock could be opened and dried out while feeding the machines from the other bin. On this class of goods comber waste is used in some mills, and the cut-roving waste is also mixed, as has been before stated. An opener and

TWO PROCESSES OF PICKING

are used, and the lap should be made as heavy as possible without, of course, making it so heavy that it will bring up the cards and finisher picker. Keep the hopper of the opener as full

as possible, and you will find that an evener lap will be made. The speed of the fan of the opener should be 1,100 revolutions per minute. The speed of the beater (of a two-bladed, rigid type) should be at least 15,000 revolutions per minute, and the weight of lap about 40 pounds or 20 ounces in weight per yard. The lap is put up at the breaker and doubled four into one and delivered so as to weigh 14½ ounces per yard, or about 39 pounds for the whole lap. The

SPEED OF THE BEATER

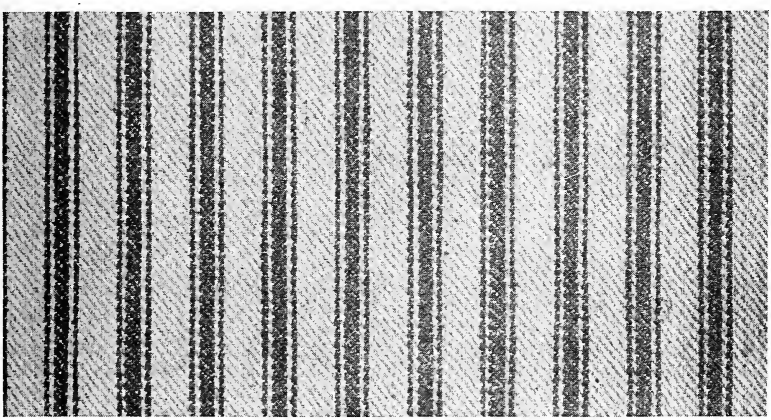
on this machine should be 1,450 revolutions per minute. The beats per inch that the cotton would receive would be about 42. See that all your drafts on the picker are properly regulated, so that a lap will be obtained that will not split. Of course, this is not the only reason that makes a lap split, but it is one of the principal ones. Another cause for split laps is found in putting too much waste in the mixing. The lap is then put up at the card which should be provided with coarse wire fillet. The

DRAFT OF THE CARD

should not exceed 100. The weight of the sliver should be about 65 grains per yard and the production about 1,000 pounds per week of 60 hours. The cards should be ground at least once every month, having the grinding rollers on for at least a half a day. Of course, grinding means loss of production, but it has to be done; otherwise, bad work will result, and if you keep your wire sharp you will find that you will have less trouble with your cards and a great deal less kicking on account of poor work.

THE SETTINGS

that should be used for this class of goods have been given in a previous lesson. The card sliver should be put through two processes of drawing, the sliver weighing 75 grains per yard at the finisher drawing frame. Remember never to draw more than you double. The sliver is passed through the slubber and the hank roving should be about .40. Set the rolls for ⅞-inch stock on this machine as follows: Front to middle, 1⅛ inches; middle to back, 2 inches. Two processes of fly frames should be used, the hank roving being made at the first intermediate about 1.40, and at the second from 3 to 3.40.



Ticking.

THE SPINNING.

This roving is then taken to the spinning room, where it is spun into the required count. For 16s the following would be a good equipment for a warp frame: gauge of spindle, three inches; diameter of ring, two inches;

length of traverse, seven inches, and for a filling frame: gauge of spindle, 2¾ inches; diameter of ring, 1½ inches, and length of traverse, from 6½ to 6¾ inches, according to twist put in; the more twist the more length of traverse may be used. The production for a spinning frame for 16s, with the speed of front roll 139 revolutions per minute, twist 19 and revolutions of spindles 8,300, would be about 3.15 pounds per spindle per week. For a filling frame for 16s, with front roll speed of 159 revolutions per minute, twist per inch 13, speed of spindles 6,500 revolutions per minute, the production would be about 3.34 pounds per spindle per week.

Dyeing Particulars.

Formerly ticking had only blue stripes dyed indigo blue. For some time a variety of colors have been introduced, and now many colors are used, some with narrow stripes mixed with broad stripes, having from three to five or more different colors in the same pattern.

BLUE.

Dyed with indigo or one of the sulphur blues.

Eight per cent pyrogene indigo; 8 per cent sulphide sodium; 3 per cent soda ash; 20 per cent common salt.

This color can be after-treated with 1½ per cent chrome; 1½ per cent copper sulphate; 3 per cent acetic acid, 125 degrees F.

ECRU.

One-quarter per cent tetrazo cutch brown; ⅛ per cent tetrazo black N.; 2 per cent soda; 20 per cent Glauber's salt.

LIGHT BROWN.

Three per cent Thion brown G.; 2 per cent soda; 3 per cent sulphide soda; 20 per cent Glauber's salt.

LIGHT SLATE.

Three-fourths per cent Thion black B.; 1½ per cent sal soda; 1 per cent sulphide soda; 10 per cent Glauber's salt.

RED.

Three per cent tetrazo red 4 B.; 2 per cent sal soda; 20 per cent Glauber's salt.

DARK BROWN.

One and one-quarter per cent Thion black B.; 5 per cent Thion brown G.; 3 per cent sal soda; 6 per cent sulphide soda; 20 per cent Glauber's salt.

LIGHT BRONZE.

One-quarter per cent tetrazo chlorine yellow GG.; ¼ per cent tetrazo black N.; ¼ per cent tetrazo brown R.; 1 per cent sal soda; 20 per cent Glauber's salt.

DRAB.

One-eighth per cent benzo fast black; ¼ per cent chloramine yellow M.; 1-16 per cent benzo fast red GL.

LIGHT OLIVE.

One-half per cent benzo dark green GG.; ½ per cent chrysophenine.

DARK OLIVE.

Four per cent benzo dark green GG.; 2 per cent chrysophenine. The above three colors are each dyed with 20 per cent Glauber's salt and 2 per cent sal soda.

DARK SLATE.

Two and one-quarter per cent benzo fast black; ⅛ per cent benzo fast blue BN.; 2 per cent sal soda; 20 per cent Glauber's salt.

WINE.

Four per cent benzo fast scarlet 8 BS.; 1 per cent benzo fast violet R.; 2 per cent sal soda; 20 per cent Glauber's salt.

LIGHT FAWN.

One-half per cent diamine brown M.; ⅛ per cent diamine brown 3 G.; 2 per cent sal soda; 20 per cent Glauber's salt.

STEEL.

One-half per cent diamine steel blue L.; ½ per cent diamine black B. H.; ¼ per cent diamine fast yellow B.; 2 per cent sal soda; 20 per cent Glauber's salt.

OSNABURG

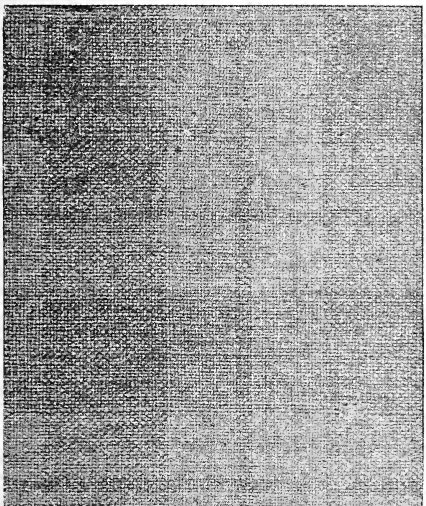
Osnaburg is a coarse, single cloth composed of all-cotton yarns, 1-16s, 1-18s, 1-20s, warp and filling, and is made in warp stripe patterns and in

checks, the colors invariably being indigo blue and white or dark brown and white.

It is manufactured into overalls and jumpers or mock shirts, and is used in the South by the colored farm and plantation laborers. It is a strong fabric, having

EXCELLENT WEARING QUALITIES,

and is especially adapted to any pur-



Osnaburg.

pose wherein it must sustain rough usage. It is occasionally substituted for canvas or duck in making awnings for back porches in northern cities. In this case the stripe patterns are used.

The check patterns, "produced by using the same pattern in warp and filling," are usually broad effects, belonging, in fact, to the plaid order of patterns. These checks measure from one to two inches either way.

WOVEN WITH A PLAIN LOOM.

Osnaburg is always woven with a plain weave $\frac{1}{1}$, and in the stripe patterns the stripe is made with warp, all white filling being used. This line can be woven on any plain sheeting loom as it requires but one filling box. The check patterns are made on any loom having a box motion attached.

In arranging check or plaid patterns the strong, long or broad way of the pattern indicates the filling and the greatest number of threads per inch indicate the warp, and to square a check or plaid pattern means to practically produce the same color effect in the filling as in the warp. Hence the filling pattern (total number of picks)

MUST BE REDUCED

so as to create a check or plaid pattern in which the filling arrangement is just noticeably longer in effect than in the warp pattern, the supposition being that as checks or plaids are worn they are always observed at an angle of several degrees, thereby in a sense overcoming any reasonable excess in the length of filling pattern, as compared with that of the warp.

Osnaburg is sometimes sized in the finishing, and at other times is not, this point being optional with the manufacturer in accordance with the purpose for which the cloth is intended to be used. Generally, it is taken from the loom, measured, run through the brusher, and after being lapped or rolled is pressed and put in the case and shipped.

Construction—30-inch Finish.

Reed, 900—33¾ inches in reed, including 16 ends selvage, two ends per dent; 1-16s warp and filling; 46 picks per inch filling; 10 per cent take-up; 1,696 plus 16 equals 1,712 ends in warp. 1,696 divided by 80 equals 21 patterns plus 16 ends plus selvage.

WARP PATTERN.

36 blue	Filling same.
20 white	
4 blue	
20 white	
80	

40 ends blue per pattern x 21 equals 840 plus 16 equals 856 ends blue; 40 ends white per pattern x 21 equals 840 plus 16 equals 856 ends white; 46 picks x 33¾ equals 1,752 yards filling equals 876 yards blue, 876 yards white.

9417

856 ends blue	+ 10% take-up =	951 yards 1-16s =	1.135 ounces	Warp.
856 ends white	+ 10% take-up =	951 yards 1-16s =	1.135 ounces	
		876 yards 1-16s =	1.043 ounces	Filling.
		876 yards 1-16s =	1.043 ounces	
			4.356 ounces.	

Brush and press.

Carding and Spinning Particulars.

As the cloth under description in this issue is made and used in the South, it is to a great extent made only in southern mills, and the machines required to produce this class of yarns belong to the first division of mills previously given, i. e., the mills making low and medium count yarns. The counts of the yarn required to make this class of goods vary from 1-14s to 1-20s warp and filling, but for this article we will assume the warp and filling yarns to be 1-20s. These yarns are made from a short staple low-grade cotton of about ⅞-inch staple.

THE MIXINGS

should be as large as possible, and the mixing is generally done by hand in southern mills. It is run through 2 processes of picking and an opener and waste is sometimes used in the mixture, i. e., card strips and comber waste (when it is possible to obtain it). Too much waste should not be used because of the trouble that it gives on the machines of the card room, such as licking, etc.

THE HOPPER

should be kept as full as possible, so that the amount of cotton fed to the opener will be as uniform as possible. It will be understood that if the hopper is allowed to get almost empty before filling it up the lifting apron of the hopper will not carry or lift as much cotton on its spikes and oftentimes there will be little or no cotton presented to the evener roller. This is sure to produce an uneven lap at the front of the breaker picker. If on the other hand the hopper is always kept full of cotton the lifting apron will always have a surplus of cotton on it, this surplus being struck off by the evener and dropped back into the hopper again. It will thus be seen that to keep the hopper more than half full all the time is one of the most important points of the picker room, because, if you have an uneven lap to start with, you will have to make the succeeding machines overwork to obtain an even yarn. The speeds of the various parts of the picker should be about the same as given in the last article and the weight of the finished lap should be at least 39 pounds at the finisher picker. Always keep laps enough in the card room so that, if an accident happens to the picking machinery, the cards will not be stopped for laps. Keep at least 10 per cent ahead.

The wire fillet used on the cards should be coarse, that used on the cylinder being

ONE NUMBER COARSER

than that used on the doffer and flats. A great many mills in the South use No. 33 wire on the cylinder and No. 34 or No. 35 on the doffer and flats. On this class of goods use as large a diameter doffer as possible, either a 26 or 27 inch. Grind cards often and keep top flats sharp, because if the flats are dull, good carding cannot be obtained. The draft of the card for this class of goods should not exceed 100. The speed of the licker-in should be at least 350 revolutions per minute. The

WEIGHT OF SLIVER

at front should be about 65 grains per yard. The sliver is put through two processes of drawing, the weight of sliver at the front of the finishing being about 70 grains per yard. The settings of the drawing frame rolls should be as follows: for ⅞-inch stock, front to second roll, 1⅛ inches; second to third, 1⅜ inches; third to back, 1⅞ to 2 inches. The slubber roving should be .50 hank.

Two processes of fly frames are used, the hank roving at the first intermediate being 1.50 and at the secand 4.00 hank. Always look out for bunches at the fly frames and be sure

that your steel rolls are set to the best advantage. Keep your

TOP LEATHER ROLLS

in perfect condition, and do not run one that is cut, bruised, uneven or channeled. See that the traverse guides are all working so as not to make channeled rolls. The cotton roving is taken to the ring spinning room and here made into the required count of yarn. The following are good particulars to be used on 20s warp and filling on spinning frames: warp, gauge of spindle 2¾ inches; diameter of ring 1½ inches, length of traverse 6½ inches; for filling, gauge of spindle 2¾ inches, diameter of ring 1½ inches; length of traverse 6½ inches; speed of spindles 7,250 revolutions per minute. Use any of the best spindles on the spinning frame. The yarn is taken to the spooler room, spooled and then run on a warp beam, thence to the slasher where it is sized and then is ready for weaving unless the yarn has to be dyed before being woven as in the present article. Then the method differs somewhat.

Dyeing Particulars.

Light blue is dyed with the ordinary indigo blue vat, but as sulphur blues are faster to exposure and washing they are mostly dyed.

LIGHT BLUE.

1 per cent immedial indone 3B., ½ per cent immedial indone B., 2 per cent sulphide sodium, 2 per cent soda, 20 per cent Glauber's.

DARK BROWN.

4 per cent immedial cutch O., 6 per cent immedial brown A., ½ per cent immedial black NG., 10 per cent sodium sulphide, 3 per cent soda, 30 per cent Glauber's.

SLATE.

1½ per cent katigen black SW., 2 per cent sulphide sodium, 2 per cent soda, 30 per cent Glauber's.

RED.

5 per cent benzo fast red 4 BS., 3 per cent sal soda, 30 per cent Glauber's.

LIGHT ORANGE.

2 per cent immedial orange C., 2 per cent sodium sulphide, 3 per cent soda, 20 per cent Glauber's.

DRAB.

1 per cent immedial black NG., 1 per cent immedial brown A., 2 per cent sodium sulphide, 30 per cent Glauber's, 3 per cent soda.

SHEETING

Sheeting is a light-weight, single cloth, composed of all-cotton yarns, from 1-18s to 1-40s warp and filling, standard goods weighing 2½ to 6 yards per pound. It is sold in both the gray and bleached state, the bleaching being done after the cloth is woven.

Sheeting is never made in colors or patterns, but always in solid bleached or unbleached effects, and is woven on any and all single box looms, cotton harnesses being used in most cases.

Automatic looms have been used in increasing quantities for the production of all kinds of sheeting fabrics. Most of these cloths contain rather coarse yarns, and are made with a plain weave, and this is the field in which automatic looms show their greatest savings. In some cases the automatic loom will contain a hopper in which quite a number of filing bobbins are placed and in other cases a magazine of shuttles will be noted. In the first case the bobbin changes whenever the filling breaks, or runs out, while in the second instance the entire shuttle is changed. As a general thing, manufacturers in the southern states have

ADOPTED THE AUTOMATIC LOOM

relatively much faster than manufacturers in the northern states, mainly because mills in the South are newer and could install more up-to-date machinery when being built. To-day's prices for many types of sheetings and print cloths are being made upon an automatic loom basis, and for this reason some manufacturers are to-day finding it hard to regularly obtain a reasonable profit. It would not be surprising if such man-

ufacturers would ultimately be forced into installing such machinery if they are to receive a profit. The range of fabrics possible upon these looms has widened greatly during the past five years, and many shirtings and what would have been considered quite fancy materials only a short time ago are to-day being woven upon them. In a number of instances the automatic loom base is being used together with the jacquard head motion, and the results obtained seem highly desirable.

Sheeting warps are all made on

THE SLASHER,

there being either four or six beams to a set, and these are filled with yarn run from spools set in the creel rack of the warp mill. Each beam has a proportionate number of the total warp ends, viz. 2,000 ends, four beams, equals 500 ends per beam. These beams are set in regular order at the further end of the slasher frame. The total warp ends are then run through a solution of size, and around the hot cylinder, and then upon a beam, thereby sizing and beaming the warp at one operation.

Sheeting requires nothing in the way of finishing, except being run through a plate folder, on which machine, having a brush attached, the cloth is at once brushed and folded in any desired length of fold.

36 inches is the standard width for sheeting.

CONSTRUCTION.

Always a $\frac{1}{1}$ plain weave.

4 square inches equal 4.15 grains.

36 x 36 equals 1,296 x 4.15 equals 5,378.4 divided by 4 equals 1,344.6 divided by 437.5 equals 3.07 ounces per yard.

30 pieces yarn (warp) x 2½ inches equals 70 inches equals .89 grains minus 6 per cent size equals .83 grains. 70 x 7,000 equals 490,000 divided by .83 equals 590,361 divided by 36 equals 16,399 divided by 840 equals 19.5 or 1-20s warp.

60 pieces yarn (filling) x 1½ inches equals 90 inches equals .89 grains. 90 x 7,000 equals 630,000 divided by .89 equals 707,864 divided by 36 equals 19,662 divided by 840 equals 23.41 or 1-24s filling.

48 ends per inch plus 44 picks per inch equals 44 ends in reed and 42 picks in loom.

Reed 800—2 ends per dent, 38 inches, including 16 ends selvage, 6 per cent size on warp 10 per cent take-up on warp, 5½ per cent contraction in width.

1,728 plus 16 equals 1,744 ends plus 10 per cent take-up equals 1,937 yards, 1-20s warp equals 1.83 ounces; 42 picks x 38 equals 1,586 yards, 1-24s filling equals 1.25 ounces; total 3.08 ounces.

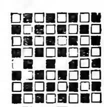
Standard grades equal 36 inches wide.

52 ends, 52 picks, 1-20s cotton warp and filling; 6 per cent size, 5½ per cent shrinkage in width in weaving; 38 inches in reed; 4.10 yards per pound.

64 ends, 64 picks, 1-32s warp, 1-40s filling; 6 per cent size, 5½ per cent shrinkage in width in weaving; 38 inches in reed; 5.86 yards per pound.

Carding and Spinning Particulars.

The counts of the yarns used in making sheetings vary in different


Plain Weave


Drawing-in Draft


Reed Plan

parts of the country in different mills and even in the same mill two grades of sheetings are sometimes made. The mills that make sheetings may belong to any one of the three divisions as given in a previous article. In this article we will consider the sheetings in two grades, the first being made up of 18s warp and the finer grade made up of 40s warp and filling. The first or

COARSE GRADES OF SHEETINGS

are made in the first division of mills and the staple of cotton used would

be about one inch in diameter. The mixing would in most cases be performed by hand and should be as large as possible. It would be put through two processes of picking, first being run through an opener. The speeds of the various parts on the machines in this room would be as follows: Speed of beater on openers, 1,050 revolutions per minute; fan, 350; speed of beater on breaker picker, 1,500 revolutions per minute; speed of fan 1,400 revolutions per minute; speed of beater on finisher picker, 1,450 revolutions per minute; speed of fan, 1,100 revolutions per minute. The

WEIGHT OF THE LAP

at the different machines for this class of goods would be as follows: At the front of the breaker picker, 40 pounds or 16 ounces to the yard; at the front of the finisher picker, 39 pounds or 14½ ounces to the yard. Always keep the hopper of the opener full. The above speeds and number of processes could also be used for fine sheetings, using 40s yarn with the following exceptions: Instead of being mixed by hand, a bale breaker and conveying trunks would be used, and the staple of cotton would be about 1⅛ inches. The weight of the lap at the breaker would be about the same, but at the finisher picker would be less or about 35 pounds for the total weight of lap or 12½ ounces to the yard. Always have laps of both classes uniform in weight, and if the laps vary one-half a pound in either direction from standard weight, they should be set aside and put back into mixing. Use cut roving in the mixing, mixing it as shown in a previous article. Double four into one in the picker room. The

SETTINGS FOR THE CARD

for the coarse sheetings should be wide, because of the large weight of cotton lap being passed through, and coarse wire should be used, 33 on the cylinder and 34 on tops and doffer. The drafts should not exceed 100 and the production should be about 900 pounds per week of 60 hours, the weight of the sliver being 65 grains to the yard. The settings for the finer sheetings at the card should be closer and a fine wire fillet should be used. The draft of the card should not be less than 100 and the production should not exceed 600 pounds per week of 60 hours. Grind cards and tops as often as possible and strip three times a day on both grades of sheetings. Go over the settings after each grinding and keep cards clean.

The coarser grade of sheeting is put through

TWO PROCESSES OF DRAWING,

the weight per yard of the sliver at the front being 70 grains per yard, the doublings being six into one and the speed of the front roll 400 revolutions per minute. The finer grade of sheeting is put through three processes of drawing, the other particulars being the same, excepting the settings, which are wider. Good settings are as follows: For one-inch stock, front to second roll, 1⅛ inches; second to third roll, 1¼ inches; third to back roll, 1½ inches; for 1⅛-inch stock, from front to second, 1¼ inches; second to third, 1⅜ inches; third to back, 1⅝ inches. Keep bottom steel rolls clean, and top leather rolls should always be in perfect condition. Varnish those rolls at regular intervals and always keep a supply of extra varnished rolls on hand, so that imperfect rolls may be taken out at any time and replaced by rolls in good condition. The hank of the roving at the front of the slubber should be .55 to .50 in each case. The coarser sheeting yarn has to be put through two processes of fly frames, the hank at the first intermediate being 1.50 and at the second 5 hank.

THE ROVING

for making the finer sheeting passes through three processes of fly frames, the hank roving at the different processes being as follows: First intermediate, 1.50; second intermediate, 4, and fly frame, 10. The roving for both grades of sheeting is spun into yarn on the ring spinning frame. The particulars for a warp frame for spinning 18s being No. 4 Draper, McMullen or Whitin spindle; gauge of frame, 2¾ inches; diameter of ring, 27 inches;

traverse, 7 inches; speed of spindle, 9,400 revolutions per minute, turning off about 2½ pounds per spindle per week of 60 hours. For a warp frame making 40s yarn, use No. 2 Draper, McMullen or Whitin spindle; gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; traverse, 6½ inches; speed of spindle, 10,000 revolutions per minute, producing about .95 pounds per spindle per week of 60 hours. The warp yarn is spooled and warped and run through the slasher. A good

SIZE MIXTURE

for 18s yarn, one set of beams, 1,500 to 2,000 pounds, is as follows: 160 gallons of water, 100 pounds starch, 20 to 40 pounds sizing (according to make), 2 to 8 pounds tallow, according to results. For 68 x 68 heavy sheetings, with 22s warp yarn, use 100 gallons water, 70 pounds potato starch, 4 pounds tallow and 1 pint of turpentine.

CHEVIOT SHIRTING

Cheviot shirting is a narrow, all-cotton fabric, weighing from four to five ounces per yard of 27 inches width finished and is composed of single or double ends in the warp and single filling. The effect of the double ends is entirely different from that produced by a two-ply thread, and is really meant to create a rib weave effect.

This fabric is made of cotton yarns, from 1-16s to 1-22s in the warp and filling, and the cloth contains from 40 to 46 double ends per inch in warp and 36 to 40 picks per inch in the filling. Another grade is made by weaving 36 to 62 single ends per inch in the cloth, and 19 to 52 picks per inch in the filling finished.

BY THE FIRST METHOD

there is produced a cloth that is at once stout and pliable, and having excellent wearing qualities. This cloth is used principally in the manufacture of shirts and mock shirts for the use of workmen accustomed to rough, dirty work, such as miners and railroad men, and those similarly employed. It is made in stripe pattern, usually of the darker tones of fast colors, such as dark blue, dark brown, etc., in the warp, and filling to match. In these warp stripe patterns the dark colors form the body or ground of the pattern and the white warp forms but a narrow pin stripe in the cloth. Then there are the light patterns, in which nearly all the bright colors are used, such as light blue, orange, red, light green, etc. In this case the body or ground of the cloth is formed by the white warp, and the bright color forms the pin stripe in the cloth. Print yarns are occasionally introduced in the light colored patterns to create mixed color effects. The filling in the light patterns is always white. In making cheviot shirting there is rather

A HEAVY SIZE

placed upon the warp yarn. This permits of the cloth retaining quite a percentage of size after weaving, and as this fabric receives nothing but sprinkling and pressing after leaving the loom, the excessive amount of size gives the fabric a better cover, feel, and apparent bulk, which is its most distinguishing feature as a material for workmen's shirts.

Cheviot shirting can be woven upon any plain loom, either single or double box. It is generally drawn in and woven on 4 harnesses so as not to crowd the heddles in weaving, as would be the case if but 2 harnesses were used. Most all cheviot shirting is woven with a plain weave, although sometimes a $\frac{2}{\quad 1}$ warp effect, 45 degree twill weave, is used.

CHEVIOT SHIRTING.

1 square inch equals 1.83 grains. 27 x36 equals 972x1.83 equals 1,778.76 divided by 1 square inch equals 1,778,-.76 divided by 437.5 equals 4.065 ounces per yard.

44 pieces white warp yarn x ½ inch long equals 22 inches equals .35 grains. .35 grains minus 10 per cent size on warp equals .315 grains. 22x7,000 equals 154,000 divided by .315 equals 48,888 divided by 36 equals 1,357 divided by 840 equals 1-16s cotton.

110 pieces blue warp yarn x ½ inch long equals 55 inches equals .9 grains.

.9 grains minus 10 per cent size on warp equals .81 grains. 55x7,000 equals 385,000 divided by .81 equals 475,308 divided by 36 equals 13,203 divided by 840 equals 15.71 or 1-16s cotton.

15 pieces blue filling yarn x 2 inches long equals 30 inches equals .45 grains. 30x7,000 equals 210,000 divided by .45 equals 466,666 divided by 36 equals 12,-962.8 divided by 840 equals 15.43 or 1-16s cotton.

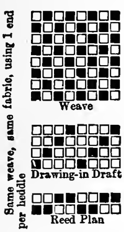
CONSTRUCTION.

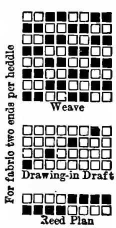
Reed, 700, 4 ends per dent; 28½ inches in reed including selvage.

532 plus 10 equals 542 splits or 2,168 ends; 1-16s cotton warp yarn.

38 picks per inch; 1-16s blue cotton filling yarn.

10 per cent size on warp; 5¼ per cent contraction in width in weaving.





WARP PATTERN.

8 blue.
2 white.
2 blue.
2 white.

14 ends per pattern.

8 per cent take-up in length of warp in weaving.

Finish equals sprinkle and press equals 27 inches finished width.

Plain weave, warp drawn in on 4 harnesses.

2,128 ends in warp divided by 14 equals 152 repeats in pattern. 10 blue ends per pattern x 152 equals 1,520 plus 40 ends blue selvage equals 1,560 ends, 1-16s blue warp yarn. 4 white ends per pattern x 152 equals 608 ends, 1-16s white warp yarn.

1,560 ends, 1-16s blue warp yarn plus 8 per cent take-up equals 1,695 yards equals 2.017 ounces. 608 ends, 1-16s white warp yarn plus 8 per cent take-up equals 660 yards equals .785 ounces. 38 picks, 1-16s blue filling yarn x 28½ inches equals 1,083 yards equals 1.265 ounces; total 4.067 ounces.

4.067 ounces per yard, 27 inches wide finished.

Carding and Spinning Particulars.

The mills hich make the counts of yarn required for cheviots belong to the second division, given in a previous article. This is one of the coarser yarns made in this division and is manufactured from stock of about 1 inch in staple. The mixings should be as large as possible and are generally done by hand, although this division of mills is generally equipped with a bale breaker. Of course, if the bale breaker is not too hard pushed or is stopped on account of all the other bins of better grades of cotton being full, then the raw stock for this class of goods will be run through the bale breaker. The bale breaker is capable of handling 80,000 to 90,000 pounds per week and requires about 2 iron horse power to drive it.

IF FLOOR SPACE IS AVAILABLE

two mixing bins should be used instead of one for reasons before stated. The cotton, after being dried out, should be run through two processes of picking and an opener. Keep the hopper of the opener as near full as possible to make an even lap at the front. Keep the pin roller of the opener clear of all cotton, so that it may be able to do its duty. On some makes this roller is a great deal of trouble, which is caused by the cotton adhering to it and winding around it until it does not strike the cotton from the lifting apron properly. This is especially true when sliver waste (from all machines which make sliver) is mixed in with the raw stock at the bins (as is customary). The speed of the opener beater for this class of cotton should be 1,100 revolutions per minute. The speed of the breaker beater should not exceed 1,500 revolutions per minute.

THE WEIGHT OF THE LAP

at the front should be about 40 pounds or 16 ounces to the yard of lap. Care should be taken that the drafts on both the breaker and finisher pickers are regulated to the best advantage so

as to obtain a smooth, firm, even lap at the front. To do this the draft is directed so that the cotton, after being acted upon by the beater, is blown on the top cage. The laps made at the breaker are put up at the back of the finisher picker and doubled 4 into 1. The speed of the finisher picker beater should be 1,450 revolutions per minute, which gives this grade and staple of cotton passing by it about 42 beats to the inch. The weight of the total lap at the front should be about 39 pounds, which gives what is known as a 14½-ounce (to the yard) lap.

OILING.

Take care to oil all rapidly moving parts of the pickers at regular and frequent intervals and keep all fly from collecting under these machines. See that the pickers are properly cleaning the cotton, and don't make the card do the picker's work. The laps from the finisher picker are put up at the back of the card, the draft of which (for this class of goods) should not exceed 100. The wire fillet used should also be not too coarse. Always keep an eye on the settings and watch the flat waste, because from the appearance of this waste we are able to tell whether the cotton is being properly carded or not.

THE SLIVER

should weigh about 65 grams per yard and the production should be around 900 pounds per week of 60 hours. Keep card wire sharp. The sliver is next run through 3 processes of drawing, the doubling being 6 into 1. The weight of the finisher drawing should be about 70 grains. The slubber roving should be about .50 hank and there should be two processes of fly frames. The roving at the first intermediate should be 1.50 and at the second either 4 or 4.50, according to whether warp or filling yarn is to be made from it, the fine hank being made into 22s filling yarn and the coarser hank roving being made into 16s warp yarn. The yarn for this class of goods is spun on a ring spinning frame, the particulars of which are as follows: For warp frame spinning 16s use McMullen, Whitin or Draper No. 4 spindle; gauge of frame, 2¾ inches; diameter of ring, 2 inches; length of traverse, 7 inches; speed of spindle, 9,400 revolutions per minute; for filling frame making 22s, spindle as above except No. 2 Draper; gauge of spindle, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6½ inches; speed of spindle, 7,400 revolutions per minute.

Dyeing Particulars.

Following are good formulas for the colors used in dyeing cheviot shirtings:

LIGHT GREEN.

2 per cent immedial yellow D; 4 per cent immedial indone 3 B; 5 per cent sodium sulphide; 3 per cent Glauber's; 3 per cent soda.

ORANGE.

4 per cent immedial orange C; 4 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's.

DARK BLUE.

3 per cent immedial indone 3 B; 3 per cent immedial indone R; 2 per cent immedial indone B; 11 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's.

DARK BROWN.

2 per cent thion black B; 8 per cent thion brown G; 10 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's.

SLATE.

2 per cent thion black B; 2 per cent sodium sulphide; 2 per cent soda; 20 per cent Glauber's.

RED.

5 per cent benzo scarlet 4 BS; 3 per cent sal soda; 30 per cent Glauber's.

YELLOW.

1 per cent chloramine yellow M; 3 per cent sal soda; 20 per cent Glauber's.

SALMON.

½ per cent benzo fast orange S; 2 per cent sal soda; 20 per cent Glauber's.

OLIVE.

5 per cent pyrogene olive N; 5 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's.

BLACK.

15 per cent katigen black S W; 15 per cent sodium sulphide; 3 per cent soda; 30 per cent Glauber's.

After dyeing, all of the colors mentioned must be well rinsed with three waters. A light soaping at the boil must then be given, followed by another rinsing. The colors will be fast to washing and will not bleed into each other.

NOVELTY DRESS GOODS

Novelty dress goods is a light-weight single cloth fabric, made from single and two-ply cotton yarns in both warp and filling, and is woven in large and small plaids, also solid colors. The distinct feature of this fabric is the prominence given the heavy yarns, which are always woven with a fancy weave in such a manner as to form an all-over effect in imitation of a jacquard pattern. The ground or body of the cloth is usually woven with a plain weave, $\frac{1}{1}$.

In the better grades of novelty dress goods, merino and silkaline yarns are often used. In making this class of goods it is sometimes necessary to use two beams in weaving, as the difference of take-up in the ground and fancy yarns will not permit of one beam being used.

Novelty dress goods are made to weigh from 3 to 5 ounces per yard; generally 1-20s to 1-30s cotton ground warp and filling yarns, and 2-20s to 2-40s, and 1-8s to 1-12s yarns are used to produce overplaided or novelty weave effects.

This fabric is made in all dress goods colors and goods patterns produced by using dark green, brown dark or cherry red, navy blue, etc., for ground color and crossing these with black.

Cotton novelty goods can be woven in any power loom having a box motion and dobby or head motion attached.

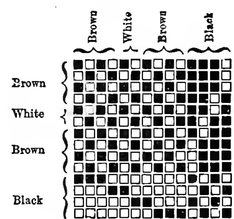
To finish these goods they are measured, then brushed and run through a steam box to liven the colors, after which they are rolled and pressed, ready to pack and ship.

CONSTRUCTION.

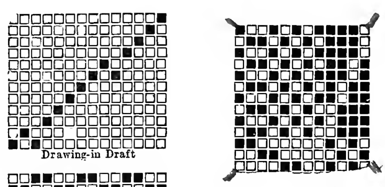
27 inches finished.

4 square inches equals 5.7 grains. 27 x 36 equals 972 x 5.7 equals 5,504.4 divided by 4 equals 1,385 divided by 437.5 equals 3.165 ounces per yard.

20 pieces black warp yarn x 2 inches equals 40 inches equals 1 grain. 40 x 7,000 equals 280,000 divided by 1 equals 280,000 divided by 36 equals 7,777 divided by 840 equals 2-20 black warp.



Design


Drawing-in Draft

Reed Plan

Chain Draft

38 pieces brown warp yarn x 2 inches equals 76 inches equals .92 grains. 76 x 7,000 equals 532,000 divided by .92 equals 578,260 divided by 36 equals 16,062 divided by 840 equals 1-20 brown warp.

12 pieces white warp yarn x 2 inches equals 24 inches equals .27 grains. 27 x 7,000 equals 168,000 divided by .27 equals 622,222 divided by 36 equals 17,284 divided by 840 equals 1-20 white warp.

24 pieces black filling yarn x 3 inches equals 72 inches equals 1.45 grains. 72 x 7,000 equals 504,000 divided by 1.45 equals 347,586.2 divided by 36 equals 9,655.17 divided by 840 equals 1-12 black filling.

17 pieces brown filling yarn x 3 inches equals 51 inches equals .5 grains.

51 x 7,000 equals 357,000 divided by .5 equals 7,140,000 divided by 36 equals 198,333 divided by 840 equals 1-24 brown.

12 pieces white filling yarn x 3 inches equals 36 inches equals .35 grains. 36 x 7,000 equals 252,000 divided by .35 equals 7,200,000 divided by 36 equals 200,000 divided by 840 equals 1-24 white filling.

50 ends per inch finished and 48 picks per inch finished equals 44 ends per inch in reed and 43 picks per inch in loom.

10 per cent take-up on white and brown warp, 2 per cent on black warp.

WARP PATTERN.

4 Brown 2 White 4 Brown 4 Black	Filling same.

32 ends white selvage.

Reed 800—2 ends per dent.

30½ inches in reed, including selvage.

95 repeats of pattern plus 4 ends.

1,334 ends plus 32 ends selvage. 8 brown per pat. x 95 patterns equals 760 plus 4 equals 764 plus 10 per cent take-up equals 848.88 yards 1-20 equals .8084 ounces. 4 black per pat. x 95 patterns equals 380 plus 10 per cent take-up equals 400.00 yards 2-20 equals .7619 ounces. 2 white per pat. x 95 patterns equals 190 plus 10 per cent take-up equals 211.11 yards 1-20 equals .2010 ounces. 32 white selvage plus 15 per cent take-up equals 37.64 yards 1-20 equals .0358 ounces. Total warp weight, 1.8071 ounces.

8-14 of filling equals brown or 740.-56 yards 1-24 equals .5877 ounces. 4-14 of filling equals black or 370.28 yards 1-12 equals .5877 ounces. 2-14 of filling equals white or 185.14 yards 1-24 equals .1469 ounces. Total 3.1294.

3.1294 ounces finished, 27 inches wide.

Carding and Spinning Particulars.

The yarns for novelty dress goods would probably be made in mills of the second division. For this class of goods three or more different counts of yarns are generally used, the counts varying from 4s to 40s, the medium yarn being from 20s to 30s. For the cloth under description we will consider that the yarns used are as follows: 8s, to produce one effect and 2-20s another, both of these yarns being used on the face of the cloth, and 1-30s for the ground warp and filling yarns. In some mills it is the custom to make all these counts of yarns from one staple and grade of cotton to save time and to reduce the number of mixings in order that the cotton may pass up to a certain point on the same machines, the only difference being that the finer yarns are run through one more process of fly frames. While this undoubtedly saves time and machines and may be done when the counts of yarn used in the cloth do not vary a great deal, still it is generally the case to have two or even three different mixtures, one for the very coarse, one for the medium and one for the fine yarns. In this lesson we will consider that there are

TWO MIXINGS,

or in other words, two grades and staples of raw stock used, one for the 8s and another mixing for the 20s to 30s yarn. For 8s yarn the staple of the raw stock should be from ⅞ to 1 inch in length and for the finer counts, cotton of from 1 to 1⅟₁₆ inch staple may be used. The ⅞-inch stock would probably be mixed by hand, i. e., taken from the bale and pulled into small bunches and spread in the mixing bin by the help. In this mixture all good waste of the same length of staple is used, the roving waste being treated, as previously mentioned; sometimes, but not often, comber waste is used, but a large percentage should not be used.

FOR THE FINER COUNTS

the raw stock would be run through a bale breaker or, if no bale breaker was in the mill equipment, then the cotton would be mixed by hand the same as cotton for the coarser counts except that no comber waste would be used. Two processes of picking and an opener would be used with both processes. All the points in connection

with the opener given in former articles should be carefully observed; the speed of the fan of the breaker should be about 1,500 revolutions per minute for both stocks and the weight of the laps 40 pounds or 16 ounces to the yard. The speed of the fan at the finisher picker should be a little less than at the breaker picker and the speed of the fan about 1,100 revolutions per minute. This gives the cotton passing under the action of the beater about 42 beats or blows per inch. The weight of the lap of the ⅞-inch stock should be 39 pounds or 14 ounces to the yard, and for the finer counts of yarn, 35 pounds or 12½ ounces to the yard. The

DRAFT OF THE CARD

for the coarser count should not exceed 100 and for the finer count should not be less than 100. The same size of wire fillet may be used for both grades or, generally speaking, No. 33 wire fillet for cylinder and No. 34 wire fillet for doffer and top flats. The main points of difference would be in the setting of the card for the different stocks, the longer staple of cotton requiring the closer settings, the production for the ⅞-inch stock being 900 pounds and for the $1\frac{1}{16}$ inch stock from 750 to 800 pounds per week of 60 hours. The doffer of the card should be as large as possible in both cases, either 26 or 27 inch diameter. Keep

THE CARD WIRE

sharp and be sure that the wire on the flats is of uniform length, because, if this is not the case, bad work is bound to result on account of the fact that even settings of the flats with the cylinder cannot be obtained. The weight per yard of the sliver would be the same in both cottons, or 65 grains per yard. The ⅞-inch stock would be put through two processes of drawing and the longer staple three processes, doubled 6 into 1 in both cases. The weight of the sliver at the finisher drawing would be the same, or 72 grains per yard. The same hank roving would be made at the slubber, or .55 hank, although the settings of the rolls of both of the last named processes would be different. Only one process of drawing would be used on the ⅞-inch stock and at the fly frame it would be made into 1 hank roving and from here passed to the spinning room. For the $1\frac{1}{16}$ inch stock two processes would be used. At the first intermediate the slubber roving would be made into 2 hank roving and at the second the roving for 20s count yarn would be made into 4 hank and for the 30s count would be made into 6 hank. The roving would then be taken to

THE SPINNING ROOM,

where the required count would be spun. The particulars for a warp frame making 20s yarn have been given in a previous lesson; for a warp frame making 8s, the following particulars may be used; any high-grade spindle, length or traverse, 7 inch, gauge of spindle, 3¼ inches, diameter of ring, 2⅛ inches, speed of spindle, 8,100 revolutions per minute. For a warp frame making 30s use gauge of spindle, 2¾ inches, diameter of ring, 1⅝ inches, length of traverse, 6 inches, speed of spindle, 9,800 revolutions per minute. The yarn is then spooled and warped and dyed. For some of the effects produced in this class of goods two yarns of different colors are twisted together; for this a machine known as a twister is used, one thread of each color being twisted together.

Dyeing Particulars.

DARK GREEN.

4 per cent tetrazo brilliant green J; 30 per cent Glauber's; 3 per cent sal soda.

RED.

4 per cent tetrazo fast red 4 B; 30 per cent Glauber's; 3 per cent sal soda.

LIGHT SKY BLUE.

1 per cent tetrazo blue 6 B new; 20 per cent Glauber's; 2 per cent sal soda.

WINE.

3 per cent tetrazo corinth; 30 per cent Glauber's; 3 per cent sal soda.

DARK BLUE.

3 per cent tetrazo blue B X; 30 per cent Glauber's; 2 per cent sal soda.

DARK BROWN.

3 per cent tetrazo dark brown; ½ per cent tetrazo black brown; 30 per cent Glauber's; 2 per cent sal soda.

LILAC.

2 per cent tetrazo chlorine lilac B; 2 per cent sal soda; 20 per cent Glauber's.

LIGHT SLATE.

¼ per cent tetrazo black N; ¼ per cent tetrazo brilliant blue B B; 2 per cent sal soda; 25 per cent Glauber's.

DARK SLATE.

1½ per cent tetrazo black N; ½ per cent tetrazo blue 3 B; 2 per cent sal soda; 30 per cent Glauber's.

OLIVE.

¼ per cent diamine fast yellow B; 3 per cent diamine bronze G; 2 per cent sal soda; 30 per cent Glauber's.

BLACK.

5 per cent tetrazo black N; 3 per cent sal soda; 30 per cent Glauber's.

NAVY BLUE.

3 per cent tetrazo blue B X; ½ per cent tetrazo blue 4 R; 3 per cent sal soda; 30 per cent Glauber's.

The above colors are for first baths, for a standing bath. One-third of the color can be taken away from these amounts. After dyeing, yarn must be well rinsed in water.

DRILL

Cotton drill is a medium-weight single cloth, weighing from 4 to 6 ounces and composed of coarse all-cotton yarns, warp and filling. It is always made with a small uneven sided twill weave, generally $\frac{2}{}\!\!\_{1}$ (warp effect) twill weave.

Drill is sometimes made from yarns in the gray and afterwards dyed in the piece, or in solid warp color effects, such as indigo blue and dark brown, white filling being used in each instance.

It can be woven in any single box loom, and is usually drawn in and woven on cotton harness, as these are light in weight and wear better than wire heddles for this style of cotton goods.

Drills are often made upon the automatic loom because simple weaves such as are used on drills show just about as good results as when plain weave cloth is being manufactured, Whenever a heavy fabric is being made, it naturally follows that the loom is af a heavier character than when a light fabric is to be made, therefore, on drills the looms are likely to be heavier than where a light plain fabric is being woven.

THE WARP

is beamed on the slasher, the warp proper being divided into a certain number of sections, in accordance with the number of ends to be used in the drill warp. These sections are beamed on the warp mill, the yarn being run on to the beam from the spools in the creel rack. The several section beams, when completed in the warp mill, are assembled in the beam rack at the end of the slasher and the yarn from each beam is run through the size tub and over the drying cylinder of the slasher at the same time, on to the slasher beam, thus making a complete warp, the sizing and beaming being done at one operation.

Slasher warps do not have a lease in them, the yarn being kept nearly straight in place by the use of a slasher comb, which is, in fact, a shallow reed having one open side. The comb is pressed through the threads, while they are spread taut in the slasher frame and a wooden cap is then fastened upon the open side of the slasher comb, thereby holding the yarn in place for the operation of drawing in.

The drawing in is performed by girls, without the aid of a hander in, as is the case when pattern warps are drawn in from a lease.

The drawer-in for drill uses a three-bladed hook (a blade for each harness) and the harnesses or heddles are hung upon a rack immediately in front of the beamed warp. The drawer in, if experienced, will pick out three heddles and three ends at one time, and continue to do so until the total warp

ends are threaded through the harnesses or heddles.

To finish colored drill, the goods are taken from the loom and run through the brusher to remove all lint and waste threads, after which they are put through the size tubs and then dry pressed.

CONSTRUCTION.

4 square inches equals 9.95 grains. 30x36 equals 1,080x9.95 equals 10,746 divided by 4 equals 2,686.5 divided by 437.5 equals 6.14 ounces per yard finished.

30 pieces blue warp x 2½ equals 75 inches equals 1.9 grains. 75x7,000 equals 525,000 divided by 1.9 equals 276,315.8 divided by 36 equals 7,675.43 divided by 840 equals 1-10s cotton.

30 pieces white filling x 1½ equals 45 inches equals .55 grains. 45x7,000 equals 315,000 divided by .55 equals 572,727 divided by 36 equals 15,909 divided by 840 equals 1-18s cotton.

66 ends per inch finished and 48 picks per inch finished equal 63 ends per inch loom and 44 picks per inch loom. 10 per cent take-up in weaving minus 6½ per cent contraction in reed. 16 ends selvage. 30 inches finished equals 32 inches in $\frac{2}{\ \ 1}$ twill weave. 750 reed minus 3 ends per dent. Finish equals size and dry press.

66x30 equals 1,980 plus 16 equals 1,996 plus 10 per cent equals 2,218 yards 1-10s cotton warp equals 4.224 ounces. 48 picks x 30 equals 1,440 yards, 1-18s cotton filling equals 1.523 ounces.

4.224 ounces warp.
1.523 ounces filling.

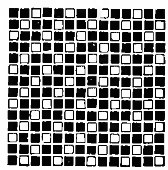
5.747 ounces loom weight.

Carding and Spinning Particulars.

The machinery used to make the counts of yarns for the kind of cloth under description would be found in mills of the first and perhaps of the second division, as given in a previous lesson. As the yarns are made from a short staple, low-grade cotton, the mixing will probably be done by hand; i. e., the bales of cotton would be opened at the mixing bin and the cotton separated into small parts and piled up in the bin until it was full. The good waste from cards and drawing frames would also be mixed in with the raw stock, and in the cheaper grades of drill comber waste is sometimes used in small quantities. The same length of staple may be used for both warp and filling yarns and they may be run through the same machines up to the fly frames, and here

THE ONLY DIFFERENCE

is that the roving to make the filling yarn is run through one more process of fly frames than the warp yarn. The mixing is taken from the bins and thrown into the hopper of the opener and this hopper is always kept full. Keep the pin beater free from cotton, so that an even sheet of cotton may be



Weave

Drawing-in Draft

Reed Plan

6.140 ounces finished.
5.747 ounces loom.

.393 ounces = sizing in finishing.

About 6½ per cent of size.

passed up to the beater, the speed of which should be about 1,050 revolutions per minute. In modern mills this opener is built in connection with the breaker picker, and the cotton, after passing the beater, is thrown on to a moving lattice and is brought to the feed rolls of the breaker picker, which in turn condenses it and passes the beater which should have a speed of 1,500 revolutions per minute. See that the draught of this picker and also the finisher picker is so directed that the cotton, after passing the beater, will be blown upon the top of the pair of cages, as this will

HELP TO MAKE AN EVEN LAP

at the front end. The weight of the lap at the front end of the breaker

should be about 40 pounds or about 16 ounces to the yard. The laps are then put up at the finisher picker and doubled four into one. The speed of this beater should be 1,450 revolutions per minute and the weight of the finished lap about 39 pounds or 14 ounces to the yard. The cotton receives about 42 beats to the inch at this machine. The draft of this machine is very small and very rarely exceeds 3. All heavy and quickly moving parts should be oiled frequently and keep the room clean. The laps are then put up at the card. The draft of this machine should not exceed 100 for this class of goods.

THE SETTINGS

should be wide, because it is the object to get off as many pounds as possible for this class of goods. Keep the wire sharp by frequent grindings. The speed of the licker-in should be about 300 revolutions per minute. The speed of the top flats should be one complete revolution in 40 minutes and the speed of the doffer from 13½ to 14 revolutions per minute. The diameter of the doffer should be as large as possible, say 26 or 27 inches. The production should be about 800 pounds for a week of 60 hours.

THE SLIVER

should weigh about 65 grains to the yard. The sliver is run through three processes of drawings, the weight at the finisher drawing being 70 grains. The doublings at the different processes of drawing should be 6 into 1 and the drafts should not exceed 6. The speed of the front roller should be 400 revolutions per minute. The slubber is the next process, and here the sliver should be made into a 50 hank roving. The warp yarn is then put through one more process of fly frame and made into 1.25 to 1.50 hank roving and from here passed to the spinning room. The filling yarn is put through one more process and is made into 2.50 hank roving and then passed on to the spinning room.

THE SPINNING FRAME

then draws the roving into the required hank by having the correct draft gear put on. Good specifications for both the warp and filling frames are as follows: For warp frame, for spinning 10s yarn, gauge of spindle, three inches; diameter of ring, two inches; length of traverse, 7 inches; speed of spindle, 8,600 revolutions per minute; twist per inch, 15.02; for filling frame spinning 18s yarn, gauge of spindle, 2¾ inches; diameter of ring, 1½ inches; speed of spindle, 7,200 revolutions per minute; length of traverse, 6½ inches; twist per inch, 13.79. The warp yarn is then spooled, warped and run through a slasher.

Dyeing Particulars.

Drills are yarn dyed, blue and brown, indigo or sulphur blues, cutch or sulphur browns.

PYROGENE INDIGO BLUE.

10 per cent color; 20 per cent sulphide sodium; 8 per cent soda ash; 35 per cent salt; 2 per cent mineral oil, 1 hour at 200 degrees F. After-treated with

1½ per cent bichrome; 1½ per cent sulphate copper; 3 per cent acetic acid, 9 degrees Tw. Well rinsed and soaped. A soap made of

2 per cent paraffin wax; 2 per cent glue; 2 per cent dextrine is considered very suitable. Turn for 15 minutes at 120 degrees F. Squeeze and dry.

BROWN.

5 per cent immedial cutch O; 1 per cent immedial dark brown A; 3 per cent immedial brown B; 8 per cent sulphide sodium; 3 per cent soda ash; 30 per cent Glauber's salt. Turn at 200 degrees F. for one hour, rinse and after-treat:

1½ per cent bichrome; 1½ per cent sulphate copper; 3 per cent acetic acid, 9 degrees Tw.; 30 minutes at 200 degrees F. Rinse and soap with a weak solution at Loil.

A variety of shades are piece dyed on drills and used for various purposes, where a very strong cloth is required.

SLATE.

3 per cent thion black B; 3 per cent sulphide sodium; 3 per cent soda ash; 20 per cent common salt. Rinse well and soap.

BLACK.

15 per cent thion black G; 15 per cent sulphide sodium; 3 per cent soda ash; 30 per cent common salt. Rinse well and soap.

BUFF.

1 per cent thion brown G; ¼ per cent thion yellow R; 2 per cent sulphide sodium; 2 per cent soda ash; 30 per cent common salt. Rinse well and soap.

OLIVE.

4 per cent immedial olive B; ½ per cent immedial black N G; ½ per cent immedial yellow D; 5 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt. Rinse well and soap.

SKY BLUE.

3 per cent immedial sky blue powder; 3 per cent sodium sulphate; 3 per cent soda ash; 30 per cent Glauber's salt. Rinse well and soap.

GREEN.

10 per cent katigen green 2 B; 10 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt; rinse well and soap.

DARK BOTTLE GREEN.

10 per cent immedial dark green B; 2 per cent immedial yellow D; ½ per cent immedial black N G; 13 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt. Rinse well and soap.

RED.

5 per cent diamine fast red; 3 per cent sal soda; 30 per cent Glauber's salt. Rinse and after-treat with 1 per cent fluoride chrome.

FLANNELETTE

Flannelette is a narrow, light-weight fabric composed of all-cotton yarns, from 1-30s to 1-14s in the warp and filling, the filling being soft spun to permit of the raising of a very slight nap on the back of the goods.

This fabrics is practically always woven from grey yarns and never from bleached yarns. In some cases where striped patterns of a woven character are being made the yarns are made by a stock dyeing process, and in this case it might be said that the yarns were of a bleached and dyed character, but by far the largest portion of the cloths are not made in this manner. When the material has been woven it is piece bleached and then the various printed patterns are placed upon the face of the goods by the printing machine. In the most successful mills these fabrics are made in the grey state upon automatic looms, and a lower cost of production obtained. Even when striped patterns are being made, or where solid colors in piece dyed effects are being produced some manufacturers have found the use of automatic looms of great advantage.

Flannelette is made with simple one or two colored stripe patterns, either black and white, or indigo blue and white, and in elaborate all-over floral designs in imitation of jacquard patterns, the ground colors being of a dark tone, and the figure of either harmonious or contrasting combinations of color. The finished fabric is sold by the retailer at 8 to 10 cents per yard, 27 inches wide, and is used very extensively in the manufacture of ladies' wrappers, kimonos, etc., for house wear, and which, when soiled, can be thrown into the family wash and cleaned.

THE PRINTING OPERATION

is performed by an automatic machine, which consists of a series of rollers or drums, over which the cloth is passed to hold it taut, and smooth all wrinkles so that the goods present an even surface to the printing roll.

Upon this roller the design or pattern is engraved, and the liquid color being fed upon it as it revolves, the cloth passes over the surface, and retains an exact impression of the design (in colors) that has been engraved upon the roller.

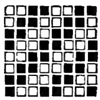
Flannelette can be woven in any single box loom, and the finish means taking from the loom and brushing off, to remove loose threads, then running through the napper to produce a

nap on the goods, after which the fabric is printed.

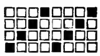
CONSTRUCTION.

27 inches finished.

4 square inches equals 4.85 grains. 27x36 equals 972x4.85 equals 5,714.20 divided by 4 equals 1,428.55 divided by 437.5 equals 3.034 ounces per yard, 27 inches wide.



Design



Drawing-in Draft

Reed Plan

Harness Chain

20 pieces white warp x 2½ equals 50 inches equals .35 grains. 50x7,000 equals 350,000 divided by .35 equals 1,000,000 divided by 840 equals 1-30s cotton warp.

16 pieces white filling x 2 equals 32 inches equals .3 grains. 32x7,000 equals 224,000 divided by .3 equals 746,666 divided by 840 equals 1-24s cotton filling.

Reed 1,460—29 1-3 inches—2 ends per dent; 16 ends selvage, 10 per cent take-up; 2,376 ends, 1-30s white cotton warp (ex. of selvage); 59 picks, 1-24s white cotton filling (soft spun); $\frac{2}{2}$ 45s twill weave (warp effect on face); finish equals very light nap on the back of the fabric or filling effect.

88 ends per inch finished and 64 picks per inch finished equals 81 ends in reed and 59 picks in loom.

88x27 equals 2,376 plus 16 equals 2,392 ends plus 10 per cent take-up equals 2,658 yards 1-30s warp yarn equals 1.687 ounces. 64 picks x 27 equals 1,728 yards 1-24s filling equals 1.371 ounces. Total 3.058 ounces.

Carding and Spinning Particulars.

The processes of machinery for making the required count of yarns for flannelette may be found in either the better class of the first division or in the second division of mills, as given in a previous lesson. A medium to low grade of cotton of from ¾ to 1⅛ inch staple may be used, according to the grade or mill in which the flannelette is made. Generally speaking, a cotton of ⅞-inch staple is used. In the first division of mills the mixing would be done by hand, but in the second division the equipment would probably include a bale breaker, and unless the mixing was pressed the cotton would be run through this machine, and as this machine will take care of 80,000 pounds of cotton there is not much danger of it being overworked.

THE MIXING

should be as large as possible and in the lower grades of flannelette the mixing would include a small percentage of comber waste, as well as the good sliver waste from the cards, drawing frames and comber rooms (if equipment contains same). The better grades of flannelette would not use waste. Roving waste would be used in both mixings, but this stock would not be mixed until the finisher picker process, and here the waste should not be mixed in a greater proportion than 1 to 4. In the modern equipments of mills generally only two processes of picking, with an opener, are used; but as there are a great many mills, which use three processes of picking, the particulars will be given for

THREE PROCESSES OF PICKING.

For this class of goods the rigid type of beater is used on all picking machines. Keep the hopper of the opener more than half full to help obtain an even lap. The speed of the beater of the opener should be about 1,000 revolutions per minute. This machine is generally used in connection with the breaker picker, and after the cotton has passed the beater, it is passed under a pair of wooden rollers onto an endless lattice which carries it to the feed rolls of the breaker picker. The speed of the beater of this machine should be about 1,500 revolutions per minute and the weight of the laps at

the front about 40 pounds or about 16 ounces to the yard.

THE DOUBLINGS

of the intermediate picker should be four into one and the speed of this beater should be the same as the finisher picker, or 1,450 revolutions per minute. The speed of the fan at this machine should be about 1,050 revolutions per minute. The speed of the driving shafts on this and on the finisher picker should be about 375 revolutions per minute. The weight of the lap at the front should be a little less than at the breaker, or about 37 pounds or a 12-ounce lap. The same particulars may be used for the finisher picker with the following exceptions: Speed of fan, 1,100 revolutions per minute and the weight of the lap about 39 pounds or about a 14-ounce lap. These particulars will answer for both warp and filling. The lap is put up at the card which should have a draft of about 100. Set the doffer to a 5-gauge and use as large a doffer as possible, either a 26 or 27 inch. The

PRODUCTION OF A CARD

for this class of work should be about 800 pounds, with a 65-grain sliver, for a week of 60 hours. On this class of goods no combing is used, but a three-process drawing. See that the proper weights are attached to the top rolls. The doublings are generally six into one, although eight into one are used in some mills. Don't draw more than you double. The draft should be about 5 at each process; speed of front rolls 400 revolutions per minute. Watch your settings of the top rolls at these machines. The hank roving made at the slubber should be about .55. Only one process of fly frames is used for warp, the hank roving being made about 2. Use square root of hank x 1.1 for twist. For the filling, a two-process fly frame is used, the hank roving being 2 at the first intermediate and 3.75 to 4.00 hank at the 2d intermediate. Use square root of hank x 1.2 for twist. The roving is now carried to

THE SPINNING ROOM

where it is made into the required count of yarn. For 14s warp yarn use the following particulars for spinning frame: Size of spindle, any first class; gauge of spindle, 3 inches; diameter or ring, 2⅛ inches; length of traverse, 7 inches. For this class of goods a soft twist is used for the warp yarn, as little as possible being put in, but be sure and put in enough so that the yarn will not break back in the loom. For a filling frame for 30s yarn use as follows: Gauge of spindles, 2¾ inches; diameter of ring, 1½ inches, length of traverse, 6½ inches. The warp yarn is then spooled, warped and put through the slasher.

Dyeing Particulars.

SKY BLUE.

½ per cent eboli blue 6 B; 20 per cent Glauber's; 2 per cent sal soda.

PINK.

½ per cent dioxyrubine G; 20 per cent Glauber's; 2 per cent sal soda.

YELLOW.

½ per cent fast cotton yellow C. extra; 20 per cent Glauber's; 2 per cent sal soda.

SCARLET.

3 per cent diamine scarlet B; 30 per cent Glauber's; 3 per cent sal soda.

WINE.

4 per cent diamine Bordeaux B; 30 per cent Glauber's; 3 per cent sal soda.

RED.

4 per cent diamine fast red F; 30 per cent Glauber's; 3 per cent sal soda.

CINNAMON BROWN.

3 per cent diamine brown 3 G; 30 per cent Glauber's; 3 per cent sal soda.

BLACK.

15 per cent pyrogene black B; 20 per cent sodium sulphide; 3 per cent soda ash; 40 per cent Glauber's.

DARK BROWN.

4 per cent chrysophenine; 2 per cent benzo fast black; 2½ per cent benzo fast red L; 30 per cent Glauber's; 3 per cent sal soda.

MYRTLE GREEN.

3 per cent benzo green G G; ½ per cent chrysophenine; ½ per cent benzo fast black; 30 per cent Glauber's; 3 per cent sal soda.

SLATE.

1 per cent benzo fast black; ½ per cent benzo fast blue B N; ⅛ per cent benzo fast red L; 30 per cent Glauber's; 3 per cent sal soda.

HELIOTROPE.

2 per cent tetrazo lilac B.; 30 per cent Glauber's; 3 per cent sal soda.

NAVY BLUE.

5 per cent tetrazo indigo blue C.; 30 per cent Glauber's; 3 per cent sal soda.

ORANGE.

3 per cent tetrazo chlorine orange R.; 30 per cent Glauber's; 3 per cent sal soda.

LEMON YELLOW.

1½ per cent tetrazo lemon yellow; 30 per cent Glauber's; 3 per cent sal soda.

DENIM

Denim is a strong, medium-weight single-cloth fabric, weighing from 4½ to 5 ounces per yard and composed of single cotton yarn in warp and filling.

It is usually made with a small, uneven-sided twill weave, such as $\frac{2}{1}$ 45° twill, and in solid color warp effects, generally indigo blue or dark brown, and white filling. White selvage is used in all grades.

A grade known as covert cloth is made of twist yarn in the warp, and dark colored single filling. The twist yarns are usually blue and white and the cloth of a similar texture to that of the regular denim.

In effect denim is a stout, twilled fabric, having excellent wearing qualities, and is made to sell at 10 to 15 cents per yard retail. It is used principally in the manufacture of overalls, to be worn by workmen who operate machinery, or by those who perform hard, rough labor of any description.

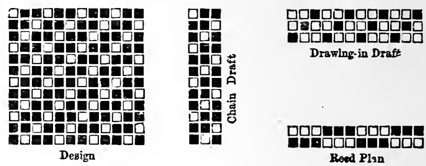
Denim can be woven on any single box loom, the warp being prepared on the slasher in the same manner as a sheeting warp. It is then drawn in on the harness or heddles, in accordance with weave desired.

The finish of this fabric is a rather heavy sizing, after which the goods are dried and pressed.

Denim is sometimes dyed in the piece, in light shades of tan, blue, etc., and the goods made up into summer outing skirts for ladies' wear.

1 square inch equals 2.6 grains. 27 x 36 equals 972 x 2.6 equals 2,527.2 divided by 1 equals 2,527.2 divided by 437.5 equals 5.77 ounces per yard, 27 inches wide finished.

20 pieces blue warp x 1 inch equals 20 inches equals .5 grains. 20 x 7,000 equals 140,000 divided by .5 equals 2,800,000 divided by 36 equals 7,777.77 divided by 840 equals 1-9s warp.



15 pieces white filling x 3 inches equals 45 inches equals .65 grains .45 x 7,000 equals 315,000 divided by .65 equals 484,615 divided by 36 equals 13,461.43 divided by 840 equals 1-16s filling.

CONSTRUCTION.

$\frac{2}{1}$ twill 45°.

68 ends per inch finished and 42 picks per inch finished equals 63 ends in reed and 40 picks in loom.

Reed 750—29 inches—3 ends per dent. 10 per cent take-up—32 ends selvage. 40 picks, 1-16s white cotton filling.

1,836 ends blue yarn and 32 ends white yarn selvage equals 1-9s cotton warp.

1,836 + 32 = 1,868 + 10% take-up = 2,076 yards 1-9 warp.....=	4.39 oz.
42 picks × 27" = 1,134 yards 1-16 filling ....=	1.35 oz.
	5.74 oz.

Carding and Spinning Particulars.

Denim is constructed of yarns that are made in either the first or second division of mills as given in a previous lesson. In the second division of mills the raw stock would be run through a bale breaker, as this class of mills would undoubtedly contain this machine in their equipment. In the first division of mills the mixing would be done by hand. When bale

breakers are used, it is of great advantage to have a blower in connection with them. This blower is generally placed at the delivery end of the machine and blows the cotton, after it has passed through the bale breaker, through trunking onto an endless lattice which deposits it in the mixing bins. A blower is of advantage because it opens the cotton and the current of air helps to dry it and the cotton does not have to dry out in the mixing bins, as is the case when a blower is not used. Mixing is

A VERY IMPORTANT PART

of the card room, and too little attention is generally given to it. It will be understood that if the cotton is not properly mixed, this defect cannot be remedied at any subsequent machine. Cotton of the same length of staple should always be used, cotton of the same nature, and where waste is used the percentage should be as small as it is possible to make it. The same mixing may be used for making both the warp and filling yarns, a medium to low grade being used of a staple length of about one inch (ranging from ⅞ to 1 1-16 inches, according to the quality of the denim being made). A small percentage of comber waste may be used, but is not advisable. The good sliver waste from the cards and drawing frames is mixed with the raw stock and the roving waste is mixed in the manner described in a previous article. The cotton would be put through two processes of picking and an opener. Keep the hopper of the opener well filled with cotton, so that the lifting apron will always be carrying up a full load of cotton to the pin roller. The

SPEED OF THE BEATER

of the opener should be about 1,050 revolutions per minute, the speed of the fan being about 350 revolutions per minute. If porcupine beater is used, the speed should be about 1,150 revolutions per minute. The speed of a two-bladed beater of a rigid type of the breaker picker should be about 1,500 revolutions per minute, the speed of the fan being about 100 revolutions less. The total weight of the lap at the head end should be about 40 pounds, or 20 ounces to the yard. The doublings at the finisher picker are 4 into 1 and the speed of the beater (two-bladed rigid type), 1,450 revolutions per minute, which will beat the cotton sheet presented to it about 42 times per inch in length. The weight of the lap in the front should be as heavy as possible and at the same time not overwork the card. A good weight would be 39 pounds or a 14-ounce lap (for a 38-inch lap). The

DRAFT OF THE CARD

should not exceed 100 and should be not less than 90. The sliver should weigh 65 grains per yard and the production about 850 pounds for a week of 60 hours. Keep your card wire sharp, and be sure that your top flats are ground even, because close and accurate settings cannot be obtained when the wire on the flats is not of a uniform length. Large doffers should also be used. The sliver would then be put through two processes of drawing frames, the speed of the front roll (1½ inches diameter) being 400 revolutions per minute on each set. The draft should not be more than the doublings and the sliver should weigh about 70 grains per yard,

THE PRODUCTION

being about 260 pounds per delivery per day of 10 hours. When metallic rolls are used, the production would be considerably greater or about 350 under the conditions noted above. Metallic rolls are coming more and more into use, especially on the lower counts of yarns, and also on a heavy sliver; although they can be used on all grades and lengths of staple, they are not generally used, but not through any fault of the rolls, as they are suitable for producing fine work. The slubber draws the sliver into .55 hank and the one-process fly frames used make the roving into a 1.75 hank roving. Sometimes two different hanks are made at the fly frame, one for the warp and one for the filling yarns; where this is the case, the warp is made from one hank roving and the filling from 2.00 hank. The particu-

lars for the warp spinning frame for No. 9s are as follows: Front roll, one inch diameter; gauge of frame, 3 inches; diameter of ring, $2\frac{1}{4}$ inches; length of traverse, 7 inches; for a filling frame making 16s use gauge of frame, $2\frac{3}{8}$ inches; diameter of ring, $1\frac{5}{8}$ inches; length of traverse, $6\frac{1}{2}$ inches. The warp yarn is then spooled, warped and put through the slasher.

Dyeing Particulars.

BLUE.

6 per cent katigen indigo B.; 6 per cent katigen indigo 5 G.; 12 per cent sulphide sodium; 4 per cent soda ash, 20 per cent salt; after-treat with $1\frac{1}{2}$ per cent bichrome, 2 per cent copper sulphate and 4 per cent acetic acid. Rinse well and soap.

BLACK.

15 per cent immedial black NN.; 15 per cent sodium sulphide; 30 per cent Glauber's salt; 4 per cent soda ash. Rinse well and soap.

BROWN.

6 per cent thion brown G.; 6 per cent thion brown B.; 2 per cent thion yellow R.; 14 per cent sulphide sodium; 4 per cent soda ash; 30 per cent salt; after-treat 3 per cent bichrome, 3 per cent sulphate copper; 5 per cent acetic acid. Rinse well and soap.

SLATE.

5 per cent pyrogene black B.; 5 per cent sodium sulphide; 2 per cent soda ash; 20 per cent salt. Rinse well and soap.

DARK GREEN.

10 per cent immedial green G.; $\frac{1}{2}$ per cent immedial black NB.; 10 per cent sulphide sodium; 4 per cent soda ash; 30 per cent Glauber's salt. Rinse well and soap.

RED.

8 per cent diamine fast red F.; 30 per cent Glauber's salt; 3 per cent soda crystals. Rinse and after-treat 2 per cent fluoride chrome at 160 degrees F.

BOURRETTE

Bourrette is a light-weight, single cloth fabric, weighing from $4\frac{1}{2}$ to 6 ounces, composed of two-ply cotton warp, and either wool, merino, or a combination of cotton and wool shoddy filling. Both the warp and the filling have an occasional end or pick of fancy bourrette or nub yarn added for effect; hence the name.

In appearance bourrette cloth is a semi-rough-faced woolen fabric, having small fancy colored lumps on the yarn, scattered throughout the goods in accordance with the effect desired. The cloth when finished is used principally in the manufacture of ladies' fall suitings.

THE WEAVE

is usually a $\frac{1}{1}$ plain weave, or a mixed twill effect, such as can be produced from the regular $\frac{2}{2}$ 45 degrees twill, viz.: diamond or entwining twill weaves. These weaves, in connection with certain warp and filling patterns, such as 1 black, 1 fancy twist or 2 black, 2 fancy twist, create very elaborate styles, as this color arrangement serves to hide the rigid outline of the design, and thus has a tendency to complicate the general appearance of the weave used in the fabric.

The fancy effects in twist that can be adapted to this line are made by twisting the following colors together, viz.:

Black and white.
Black and light blue.
Black and light green.
Black and old gold.
Black and red.
Black and light brown.

These twist yarns serve the purpose of brightening up the general appearance of the goods.

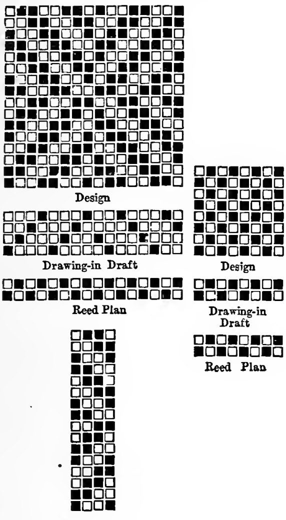
Bourrette cloth can be woven in any power loom, excepting those styles wherein a single pick of the fancy yarn is introduced in the filling, in which case a pick and pick dobby loom is necessary.

TO FINISH THE FABRIC,

the goods are taken from the loom and measured, after which they are brushed, scoured in a solution of soap and cold water, then tentered and dried and pressed.

The bourrette yarn is made by twisting two cotton threads and a worsted thread together, the worsted being allowed to deliver more quickly than the cotton threads at regular intervals.

The excess which is delivered is twisted around the cotton threads in



Design

Drawing-in Draft

Reed Plan

Harness Chain

Design

Drawing-in Draft

Reed Plan

the one place, thereby forming a lump on the twisted yarn, as the worsted yarn is run at a varied speed, and is not regularly distributed around the cotton threads.

CONSTRUCTION.

4 square inches equals 7.61 grains.

33 x 36 equals 1,188 times 7.61 equals 904,068 divided by 4 equals 2,260.17 divided by 437.5 equals 5.11 ounces, 33 inches wide from loom.

23 pieces black warp times 2 equals 46 inches equals 1.41 grains.

46 x 7,000 equals 322,000 divided by 1.41 equals 228,368 divided by 36 equals 6,343.5 divided by 840 equals 2-14s.

22 pieces twist warp times 2½ equals 55 inches equals 2 grains.

55 x 7,000 equals 385,000 divided by 2 equals 178,804 divided by 36 equals 5,216.8 divided by 840 equals 2-12s.

30 pieces black merino filling times 2 equals 60 inches equals 3 grains.

60 x 7,000 equals 420,000 divided by 3 equals 140,000 divided by 36 equals 3,888 divided by 300 equals 1-12s cut.

10 per cent up.

Reed, 400 minus 1 end per dent minus 36 inches wide, including selvage of 16 ends 2-14s black, 24 picks, 1-12 cut merino equals 75 per cent wool and 25 per cent cotton.

Warp pattern: 1 black equals 2-14s cotton; 1 twist equals 2-12s cotton.

24 picks times 36 equals 864 yards 1-12 merino equals 3.84 ounces.

192 ends black plus 16 equals 208 plus 10 per cent take-up equals 231 yards, 2-14s equals 6.28 ounces; 192 ends twist plus 10 per cent take-up equals 213 yards 2-12s equals .676 ounces; total, 5.144 ounces per yard loom.

Finish—Scour, tenter and steam press to loom width.

Carding and Spinning Particulars.

In the class of goods under description it will be noticed that there is a very small percentage of cotton contained in its make-up. If the cotton yarn that this class of goods contains was made in a cotton mill, the following particulars would be a good foundation on which to base the speeds, weight and processes through which the raw stock would have to pass before being turned out into 2-ply 12s or 2-14s yarn, as the case may be. This class of yarn may be made in the first division of mills, and the cotton would be hand mixed and put in the bins. The mixing should be allowed to dry out as much as possible before using, and a better plan would be to have two large mixing bins so that when one was in use the other one might be filled and the cotton dried. This is not always done, because most picker rooms are pressed for floor space.

THE RAW STOCK

should be put through two processes of picking and an opener. The good waste from pickers, cards and drawing frames should be put into the mixing bin before running it through the opener. Always keep the hopper of

the opener more than half full and gauge your stripping roller so that quite a heavy weight of cotton is passed to the action of the beater. The speed of the beater for the opener should be about 1,000 revolutions per minute, and the speed of the fan about 350 revolutions per minute. This machine is used in connection with the breaker picker and the speed of the beater (2 bladed rigid type), should be about 1,500 revolutions per minute. The weight of the lap at the front should be about 40 pounds or a 20-ounce lap to the yard. The laps from the breaker picker are put up at the finisher picker and doubled 4 into 1. The speed of the beater at this machine should be about 1,450 revolutions per minute, which gives about 42 blows per inch of cotton fed. The

WEIGHT OF THE LAP

should be about 40 pounds or a 14½-ounce lap. Care should be taken to see that the variation in the total weight of the laps delivered at the front of the finisher picker is not more than three-quarters of a pound from standard weight for raw stock to make goods under description, and the amount of variation for the finer classes of goods should not exceed one-half a pound from standard. When laps are found to vary more than above noted, they should be placed at the back of the finisher picker and run over. If a great degree of variation is found, i. e., if the standard is 40 pounds, and laps are delivered which weigh 39¼, 41, 39, 40¾, and so on, it shows that the picker needs adjustment, and on all makes of machines there are devices to regulate these small variations. The laps are put up at the card and the draft of this machine should not exceed 100.

THE WIRE FILLET

should be coarser, so as to stand the pressure of the weight and amount of cotton to be passed through. This wire should be kept sharp by frequent grindings with the grinding rollers. The weight of the sliver should be about 65 grains to the yard and the production of a card for 60 hours on this class of goods should be not less than 850 pounds. The cotton is put through two processes of drawing. The speed of the front roller in each case should be 400 revolutions per minute. On this grade of cotton it would be of great advantage if metallic rolls were used. The weight of the sliver at the front of the finisher drawing frame should be about 70 grains to the yard. The sliver at the drawing frames should be weighed about three times a day to see that it is the proper weight. The slubber roving should weigh about .50 hank. Only one process of fly frames is used and the hank at this should be about 1.50. The roving is then carried to

THE SPINNING ROOM,

when it is spun to the required count yarn. The particulars to spin 12s on a warp frame are as follows: gauge of frame three inches; diameter of ring, 2⅛ inches; length of traverse, 7 inches; twist per inch, 16.45; speed of spindle, 9,000 revolutions per minute. The same particulars may be used for making 14s yarn with the following exceptions, that somewhat different particulars are required for the spinning frame. The warp yarn is then spooled and taken to the twister when it is made into 2-ply or 2-14s, as the case may be, after which it is sized at the slasher.

Dyeing Particulars.

BLACK.

10 per cent immedial brilliant black B., 10 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's.

For the threads of colored yarn which are mixed with the black and white, fast sulphur colors are dyed.

For union yarn a one-dip aniline union black is generally dyed.

LIGHT BLUE.

10 per cent pyrogene indigo, 20 per cent sulphide sodium, 10 per cent soda ash, 35 per cent salt, 3 pints mineral oil.

LIGHT GREEN.

8 per cent pyrogene green G., 16 per cent sulphide sodium, 6 per cent soda ash, 30 per cent salt.

OLD GOLD.

4 per cent pyrol bronze, 2 per cent pyrol yellow, 6 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's.

RED.

5 per cent benzo fast red, 3 per cent sal soda, 30 per cent Glauber's.

LIGHT BROWN.

10 per cent thion brown G., 10 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's.

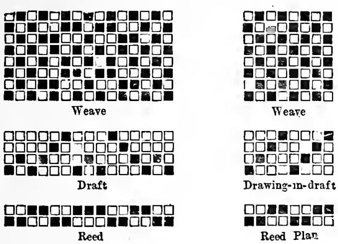
OLIVE.

4 per cent immedial olive 3G., 1 per cent immedial cutch O., 3 per cent soda ash, 30 per cent Glauber's, 5 per cent sulphide sodium.

FANCY SHIRTING

Fancy shirting is a light-wight, single cloth wash fabric, weighing from two to three ounces per yard, and composed of regular, single, cotton yarns, 1-26s to 1-40s in warp and filling.

It is made in simple stripe patterns either printed on the woven, bleached



Idea for fancy weave

fabric, or of fast colors, dyed upon the warp. Combinations of each are sometimes formed to create attractive styles.

THE WEAVE

used is either the plain $\frac{1}{1}$ or this combined with a fancy rib or basket weave.

Fancy shirting is made to retail at 8 to 12½ cents per yard, and is used in men's outing and working shirts, ladies' and children's waists, blouses and summer suits. It is from the consumer's standpoint a practically inexpensive material, which, when the garment becomes soiled, can become a part of the family wash and be readily renovated.

Those grades in which the plain weave alone is used are best adapted to the plain single box loom. The fancy styles, in which a more elaborate weave effect is desired, require a loom having a dobby.

THE FAST WARP COLORS,

generally used in connection with the bleached or white yarns to create a range of patterns for this fabric are: Dark blue, dark green, black, red, lavender, pink, ecru, tan, light green, light blue and violet.

FINISHING.

To finish this fabric the goods are taken from the loom and run through the washer, after which they are very lightly sized, then dried by the process of tentering (this also prevents undue shrinkage in width). After drying run through the calender to press out wrinkles, also to bring up a clear, even face. Then the goods are ready to lap and fold in readiness for the shipper.

CONSTRUCTION.

4 square inches equals 4.18 grains.

27 x 36 equals 972 x 4.18 equals 4,062.96 divided by 4, equals 1,015.74 divided by 437.5 equals 2.319 ounces per yard, 27 inches wide.

12 pieces blue warp times 1½ equals 18 inches equals .16 grains.

18 x 7,000 equals 126,000 divided by .16 equals 787,500 divided by 36 equals 21,878 divided by 840 equals 1-26s blue warp yarn (cotton).

12 pieces white warp times 1½ equals 18 inches equals .16 grains.

18 x 7,000 equals 126,000 divided by .16 equals 787,500 divided by 36 equals 27,878 divided by 840 equals 1-26s white warp yarn (cotton).

19 pieces white filling times 2 equals 38 inches equals .25 grains.

19 x 7,000 equals 266,000 divided by .25 equals 1,064,000 divided by 36 equals 29,833 divided by 804 equals 1-36s white filling yarn (cotton).

27 inches finished.

Reed, 1,150 minus 29 inches minus

2 ends per dent; 54 picks minus 1-36s white cotton filling; 1-26s cotton warp; 10 per cent take-up; 1,858 ends in warp plus 32 white selvage.

WARP PATTERN.

3 white.
*1 light blue } 7 times.
3 white. }
1 light blue.
3 white.
2 white in 1 heddle.
8 light blue.
2 white in 1 heddle.

47 ends per pattern, 39 repeats of pattern plus 25 ends. Start at *.

16 blue ends per pattern times 39 repeats equals 624 plus 7 equals 631 blue ends.

31 white ends per pattern times 39 repeats equals 1,209 plus 18 plus 32 ends selvage equals 1,250 white ends.

631 blue ends 1-26s plus 10 per cent equals 701 yards equals .513 ounces; 1,250 white ends 1-26s plus 10 per cent equals 1,388 yards equals 1.001 ounces; 54 picks times 29 1-36s filling equals 1,566 yards equals .828 ounces; total, 2.342 ounces.

Finish, wash, size, calender.

Carding and Spinning Particulars.

The fabric known as fancy shirting is made up of yarns, the counts of which vary from 20s to 60s, according to the mills making them, and also according to the grade being made. For the particulars that will be described below we will consider that the shirtings are made up of 1-26s warp and 1-40s filling. It is not customary for both yarns to be made out of the same length of staple or grade of cotton, although in some instances this may be done. For the 40s yarn a good grade of raw stock of about 1⅛ inches staple should be used and for the 20s yarn a cotton of about 1 1-16 inch staple may be used with advantage. The raw stock in both cases should be put through the bale breaker and deposited in their different bins, being allowed to stand as long as possible before using. This is for the purpose of drying out the cotton, as it is easier to work when in this condition. An opener and two processes of picking are generally used, although it is the custom in many mills to use three processes. When the latter is the case, the particulars given for the finisher picker may be used, except that the speed of the fan is not so great, also that the laps are of a little lighter weight. The hopper of the opener should be kept well filled so that an even amount of cotton will be always fed to the feed roll of the breaker picker. The speed of the beater (2 bladed rigid type) should be about 1,000 revolutions per minute; the fan, about 350 revolutions per minute. The speed of the beater of the breaker should be about 1,500 revolutions per minute and for the finisher picker 1,450 revolutions per minute. This gives the cotton passing through about 42 beats per inch. The weight of lap at the breaker picker is 40 pounds, or 16 ounces to the yard. At the finisher (and intermediate picker if used) the doublings are four into one. The roving cut waste is mixed at the back of the finisher picker in the usual manner. The weight of the laps at the delivery end of the finisher picker is 35 pounds for the longer stapled cotton and 39 pounds for the shorter, or a 12½-ounce lap for the filling yarn and a 14½-ounce lap for the warp yarn. The cards are set about the same in both cases, except where they are required to be set according to the length of staple.

The draft of the card should not exceed 100 for the warp yarn and should not be less than 100 for the filling yarn. As large a doffer as possible should be used with both stocks, and the weight of the sliver should be about 65 grains. The production would be 750 pounds per week of 60 hours for the filling cotton and 850 pounds for the warp yarn. Always keep the wire sharp, and never under any circumstances allow it to become dull. Grind cylinder and doffer wire at least once a month for half a day and grind top flats twice a month with "dead roller." Strip cards three times a day, both cylinder and doffer. Some overseers strip cylinders twice and doffers three or four times. This, they claim, saves time, as the doffer may be stripped while running and the sliver is not as uneven as when both doffer and cylinder are stripped at the same time. In the mills making fine yarns

it is the general custom to strip three times a day. Three processes of drawing are used for both warp and filling. The only difference made in these machines is that the rolls are spread differently for the different lengths of staple. The weight of the sliver should be about 70 grains in both cases.

The slubber makes this sliver into 50 hank roving, the standard twist being obtained by multiplying the square of the hank roving by the constant 1. On the finer classes and long stapled cotton the front top rolls of the slubber are varnished, but this class of goods does not require this to be done. The roving for the warp yarns is put through two processes of fly frames, the hank at the first intermediate being 1.50 and at the second intermediate 3. The filling roving is put through two processes of fly frames, the hank roving at the first intermediate being 2, and at the second intermediate 5. The twist standard is obtained by multiplying the square root of the hank by 1.1 for both cottons. Take special care of your top rolls to see that they are in perfect condition and not channeled, cut, uneven, oil soaked, dry at the bearings, loose or unevenly weighted. Look out for the settings at all fly frame rolls. The roving is carried to the spinning room, where it is drawn into the required count. For 26s count warp yarn a frame with the following particulars may be used: Gauge of frame 2¾ inches, diameter of ring 1¾ inches, length of traverse 6½ inches, twist per inch 24 plus, speed of spindle 9,700 revolutions per minute. For a filling making 40s the particulars have been given in a previous lesson. The warp yarn is then spooled, warped and run through a slasher.

Dyeing Particulars.

DARK BLUE.

5 per cent immedial blue C., 5 per cent immedial blue CR., 1 per cent immedial black NN., 10 per cent sodium sulphide, 30 per cent Glauber's, 3 per cent soda ash.

DARK GREEN.

15 per cent thiogene green B., 15 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's.

BLACK.

15 per cent melanogen black G, 15 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's.

RED.

6 per cent primuline, diazotized and developed with beta naphthol.

LAVENDER.

¼ per cent diamine blue 3 R. pat., after-treated with ½ per cent sulphate of copper at 160 degrees F.

PINK.

½ per cent diamine rose BD., 30 per cent Glauber's, 3 per cent sal soda.

ECRU.

2 per cent katigen yellow brown GG., 2 per cent sodium sulphide, 20 per cent Glauber's, 2 per cent soda ash.

TAN.

5 per cent thion brown G., 5 per cent sodium sulphide, 2 per cent soda ash, 20 per cent Glauber's.

LIGHT GREEN

on a tannin and tartar emetic mordant. Dye ½ per cent thioflavine T. ½ per cent new methylene blue GG.

LIGHT BLUE.

2 per cent immedial sky blue, 2 per cent sodium sulphide, 2 per cent soda ash, 20 per cent Glauber's.

VIOLET.

1 per cent diamine blue 3 R. pat., after-treated with ¾ per cent sulphate of copper at 160 degrees F.

TAPE

Tape is a very narrow fabric, composed of either cotton or linen yarns in warp and filling, and usually made with a point or broken twill weave, the break in the weave occurring in the center of the tape, and the twill lines running in a right and left hand direction.

It is made of all bleached yarns. It is made of regular yarns about 1-26s to 1-30s and 1-40s cotton and is used as a trimming, in the manufacture of clothing, also as a binding in innu-

merable cases, such as paper boxes, etc., and is sold by the roll, each roll containing a certain number of yards

A fair grade of tape weighs about 20 yards per pound.

This fabric is woven in a broad loom having a light dobby head motion attached, similar to that which is used on a haircloth loom.

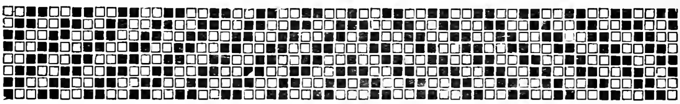
In weaving this fabric, the loom is arranged to produce several rolls at the same operation, it being very narrow. There are perhaps 20 rolls all weaving at once, as the warp yarn for which it is wound into rolls and is ready to pack and ship.

CONSTRUCTION.

Reed, 1,650 minus ⅝ inches width in reed, 59 ends, 46 picks, $\frac{2}{\quad 2}$ point twill, 30 ends minus 29 ends left.

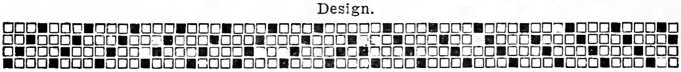
Carding and Spinning Particulars.

The counts of yarn used to make tape vary from 20s to 40s, according to the grade of tape required. In this article we will consider the warp yarn to be 1-36s and the filling 1-40s.

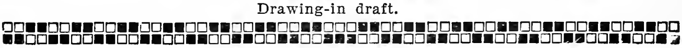


Design.

Weave



Drawing-in draft.



Reed plan.

each roll is beamed upon a small spool, thereby acting independently of every other roll on the same loom. The warps are all drawn through the same harness or heddles, which are worked from the dobby motion.

The peculiar and important part of a tape loom is the filling arrangement or shuttle motion.

Being a one-shuttle fabric, each warp has its separate shuttle, all the shuttles being operated at the same time, and by one motion. The shuttle, in traveling from one box to its mate, describes a half moon movement, and this is accomplished by a sliding rod beneath the race board, and so set that at each pick of the loom the rod moves from left to right and on the next pick right to left, and for each piece of tape being woven there must necessarily be a shuttle, and for each shuttle there is an attachment placed on the aforesaid rod in such a position that the rod in moving causes the said attachment to move the shuttle from one box to the other in the same direction as the rod is taking.

Tape requires as a finish, washing and drying on the cylinder, after

These counts of yarn would be made in the second division of mills as given in a previous lesson. For this fabric the yarn would be made out of a medium-grade cotton of from 1 to 1 1-16 inches in length. The bales of raw stock would be brought to the mixing room and stapled, and those bales of the same length of staple would be opened and run through a bale breaker (if the mill contained one, or through a willow, or it may be mixed by hand) and passed by suitable means to

THE MIXING BIN.

It should be allowed to stand here as long as possible, so that the cotton may be opened up to the air, which dries it, and makes it easier to work than when it is not allowed to stand in the bins. At this point the good waste from the pickers, cards and drawing frames should also be mixed in with the raw stock. The cotton is then put through an opener and either two or three processes of picking, generally two. If three processes of picking are used, the intermediate process presents almost the same particulars as the finisher picker. In this in-

stance, we will consider that only two processes of picking are used. The hopper should be kept as nearly full as possible, so that an even lap may be made. The cotton is fed to the feed rolls of the breaker picker, and after passing comes under the action of the beater which, if it is a rigid two-bladed type, should make about 1,450 revolutions per minute, the speed of the fan being about 1,050 revolutions per minute. The weight of the lap at the front should be about 40 pounds or a 12-ounce lap. The doublings at the finisher picker are 4 into 1. The speed of the fan should be about 1,450 revolutions per minute, and the fan 1,100 revolutions per minute. This gives the cotton sheet about 42 beats per inch fed. Watch your drafts. The weight of the lap at the front should be about 39 pounds or a 14½-ounce lap. When roving waste is mixed with the raw stock, it should first be put through

A SPECIAL PROCESS

to take out the twist, and through a breaker picker to make laps, and these laps are put up behind the finisher picker. These laps are mixed with the raw stock in a proportion of one lap roving waste to three laps of raw stock. The laps are put up at the card, the draft of which should not be less than 100. In speaking of cards we refer to the so-called English card and not the American card. The wire fillet of this card should be about No. 34 wire on cylinder and No. 35 wire on doffer and flats. This is equivalent to 110s and 120s, English count, and gives 79,200 points per square inch for cylinder and 86,400 points per square inch for doffer and top flats. Grind the wire so as to keep it sharp and strip three times a day.

THE SLIVER

at the front of the card should weigh about 65 grains per yard and a production of 800 pounds should be turned off for a week of 60 hours.

Use as large a doffer as possible, either a 26 or 27 inch one. The sliver is put through three processes of drawing frames, doubling six into one, the speed of the front roll being 400 revolutions per minute, and the weight of sliver at the finisher drawing 70 grains to the yard. Always keep a stock of freshly varnished rolls on hand, so that if those in the frames become worn or damaged in any way they may be replaced at once. All the rolls should be varnished and changed at least once every two weeks. Drawing frames should be cleaned at least once a month. The settings of

THE DRAWING FRAME ROLLS

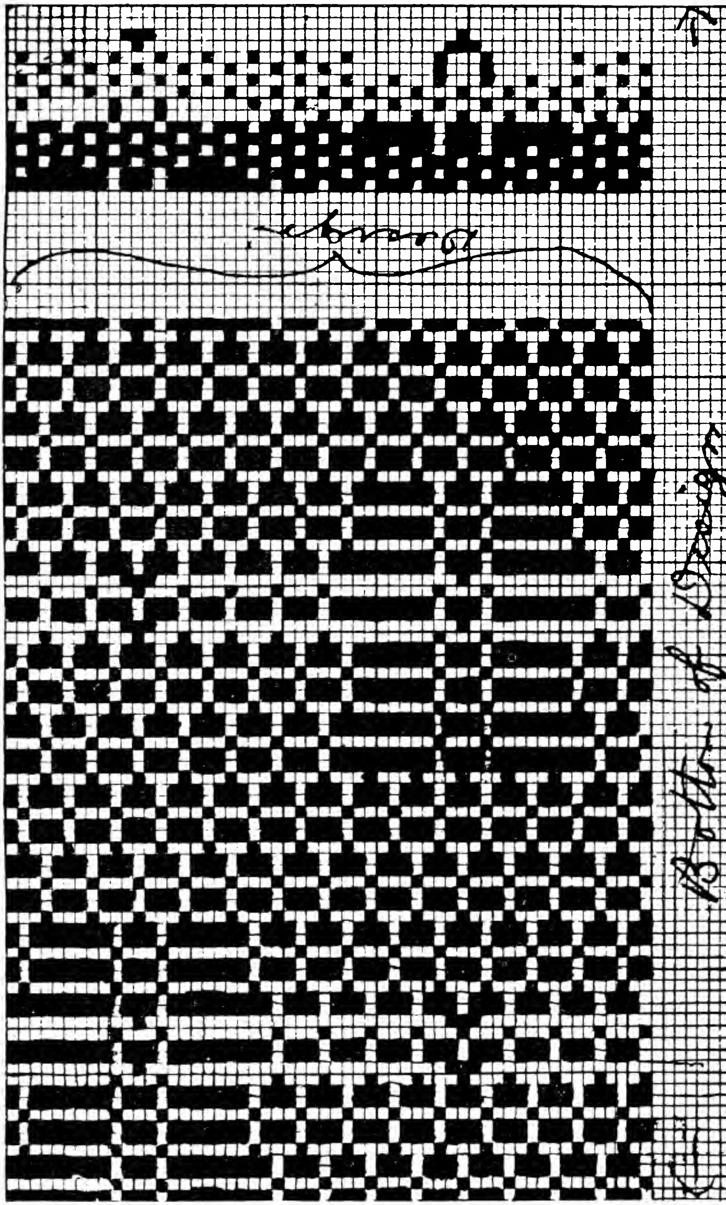
should be looked after frequently to see that they have not slipped. The sliver is then passed to the slubber which draws and twists it into .50 hank roving. Watch your leather covered rolls to see that they are perfect. The roving is then put through three processes of fly frames, the hank roving at the first intermediate being 1.50, at the second 3.50 hank and at the jack, 9 to 9.50 for both counts of yarn, the doublings being two into one in every case. Use the standard multiplier for twist previously given. The roving is then taken to the spinning room and made into the required count. The particulars for a warp yarn of 36s count are as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverve, 6½ inches; speed of spindle, 10,200 revolutions per minute.

MERCERIZED VESTING

Mercerized vesting is either a light or heavy weight cotton wash fabric weighing from 5 to 8 ounces per yard finished, and is made of one, two or three warps and one or two fillings. When made of one warp and filling, a light weight can be produced in case the warp and filling are both mercerized yarns.

The warp for the face of the cloth ranges from 2-20s to 2-60s mercerized cotton, and the filling from 1-10s to 1-16s cotton.

The styles range from granite and basket weave effects in solid white, to the more elaborate figured patterns, such as are created by forming spots on the face of the cloth, from warp effect diamond, cross and curved twill weaves, so arranged as to scatter the



Harness Chain.

design in regular formation, in imitation of jacquard designs.

ADDING WEIGHT.

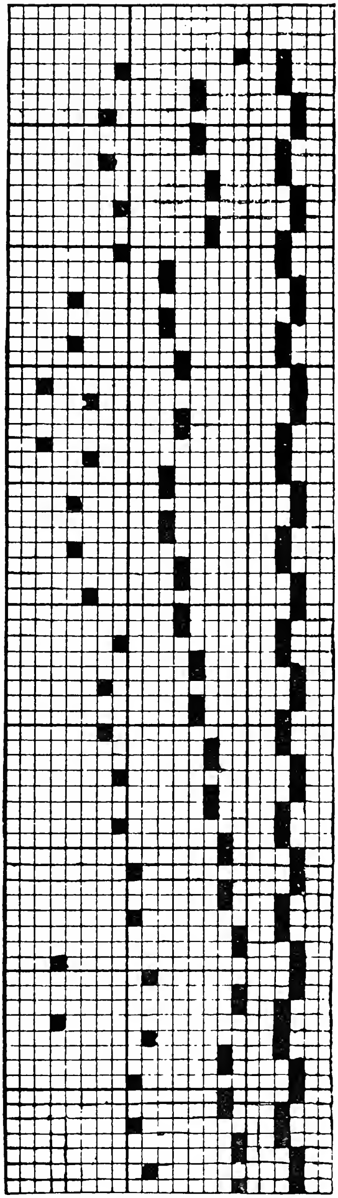
The extra back warp is for the purpose of adding weight to the fabric, also permitting greater scope in face weave effects, the idea being to so arrange the face weave as to thoroughly cover the coarse filling, the back warp binding the filling into the cloth under the figure floats of the face weave.

In making a vesting having a back warp, always use a two-ply yarn for this warp, as a single yarn will bead in the weaving, which means a loss of time every few hours in removing same, and the warp will not shed properly when the yarn is beaded, which causes the reed to cut the yarn. The quickest way to remove the beads from the yarn in the shed is to loosen the top of the reed cap, and lay the reed upon the cloth. The beads may then be either cut off, or drawn through the reed. If the latter method is used, the beads form a line of small lumps upon the face of the cloth, from one selvage to the other. While this in itself is not a serious imperfection, it means that the cloth must be cut at this point to remove the lumps, which to a certain extent destroys the utility of the piece in manufacturing the garments.

EITHER A DOBBY OR JACQUARD.

This fabric can be woven on either the dobby or jacquard loom. Most of the popular imported jacquard effects can be imitated successfully on the dobby loom, having either single or double box filling motion. It is best adapted to the Knowles Gem Harness loom, or the Fairmount, 4 x 1, box loom, having the Ingraham head motion attached.

To finish this fabric, the cloth goes from the loom to the measuring machine, after which it is scoured, during which operation the goods are run through a solution of soap and cold water to remove all stains such as mill dirt and grease spots. After washing it is calendered or pressed, and each piece is folded and doubled up in heavy paper and tied with a cheap tape. It is then ready to pack and ship.



Reed Plan. Drawing-in Draft.

A style having great vogue in the spring of 1904 was a mixed effect, produced by using an all white mercerized warp, and black mercerized filling, the ground weave being 1 up, 1 down, and the figure, small, double-headed triangles.

Reed, 700 minus 30 inches in reed 4 ends per dent in reed; 2-20s white mercerized warp, 2-20s black mercerized filling; 48 picks. Weight about 7½ ounces.

CONSTRUCTION.

62 ends face finished, 31 ends back finished, equals 93.

1 square inch equals 3 grains; 60 picks finished; 29 x 36 equals 1,044 x 3 equals 3,132 divided by 1 equals 3,132 divided by 437.5 equals 7.16 ounces per yard.

$\frac{2}{\quad 1}$ face ends, back ends.

30 inches in reed including selvage; 29 inches finished. Scour and calender.

16 pieces mercerized face yarn times 3 inches equals 48x7,000 equals 336,000 divided by .95 grains equals 353,684 divided by 36 equals 9,824.5 divided by 840 equals 11.69 or 2-20s mercerized yarn.

8 pieces back yarn times 2 equals 16 x7,000 equals 112,000 divided by .18 equals 62,444 divided by 36 equals 17,345.5 divided by 840 equals 20.64 or 2-40s back warp yarn.

17 pieces filling yarn times 2 equals 34x7,000 equals 238,000 divided by .7 equals 340,000 divided by 36 equals 9,444 divided by 840 equals 11.24 or 1-12s filling yarn.

3 pieces fancy color (spot) yarn times 3 equals 9x7,000 equals 63,000 divided by .1 equals 630,000 divided by 36 equals 17,500 divided by 840 equals 20.8 or 2-40s extra warp (for figuring) yarn.

30 inches in reed, 30 dents per inch in reed, 900 minus 10 splits equals 890 splits, 40 ends 2-40s cotton selvage, 76 ends in repeat of pattern equals 23 repeats plus 32 ends.

1,780 ends 2-20s mercerized face ends, 890 ends 2-40s cotton back ends, 40 ends 2-40s cotton selvage ends, 94 ends 2-40s cotton colored ends, equals 900 splits or 30 inches in reed.

3 1-3 per cent contraction in width in weaving, 5 per cent take-up, 6 2-3 per cent shrinkage in length in finishing.

1,780 ends plus 5 per cent take-up equals 1,873.7 yards, 2-20s mercerized equals 3.568 ounces, 890 ends plus 5 per cent take-up equals 936.8 yards 2-40s cotton equals .892 ounces, 94 ends equals 94 yards 2-40s cotton equals .009 ounces, 40 ends plus 5 per cent take-up equals 421 yards 2-40s cotton equals .04 ounces, 56 ends 1-12s filling times 30 inches equals 1,680 yards 1-12s cotton equals 2.666 ounces; total, 7.175 ounces finished.

Carding and Spinning Particulars.

The counts of yarn required to manufacture the fabric under description would be made in the third or possibly in the second division of mills, as given in a previous lesson. It will be understood that a great many grades of fancy vestings are made and that the range of the counts of the yarns is also varied. For this article we will consider that the warp yarn count is 2-60s and that the filling yarn is 16s count. The grade of cotton used for the finer count should be good and the length of the staple about 1⅜ inches. For the coarser yarn a cotton with the staple of 1 inch may be used. The two different cottons would be

TREATED ALIKE

up to a certain point and unless otherwise noted what is said may be applied to both cottons. The cotton raw stock should be first brought to the bale breaker and there stapled and graded by the overseer and all bales not up to the proper standard laid aside. Several bales should be opened and placed around the bale breaker and fed to this machine alternately; that is, first a section from one bale and then a section from another, until all the cotton is fed, and not one bale fed until it is all gone. By the first method a more even mixing is obtained. Two processes of picking and an opener are generally used, and after allowing the cotton to stand in the

bins as long as possible, where the good sliver waste from the cards, sliver lap and ribbon lap machines, combs, drawing frames and slubber is

MIXED WITH THE RAW STOCK,

the cotton is fed to the hopper of the opener. This machine is really the first machine that evens the cotton so that a certain weight of cotton will be delivered for a certain length. In order to accomplish this the hopper should be kept as nearly full as possible, so that the lifting apron will always be loaded. The speed of the beater of this machine is about 1,050 revolutions per minute, having a fan speed of 350 revolutions per minute. The cotton is delivered from this machine to the feed rolls of the breaker picker. The speed of a rigid two-bladed type of beater should be about 1,500 revolutions per minute, the fan speed being 1,400 revolutions per minute. The

WEIGHT OF THE LAP

delivered at the front should be about 40 pounds or a 16-ounce lap for the finer counts and 20 ounces for the coarser counts. The laps are then put up at the finisher picker and doubled four into one. It is at this point that the cut-roving waste is mixed in, this waste having gone through a special process to take out the twist. Mix one lap of cut waste to three of raw stock laps. The speed of the beater for this class of goods should not exceed 1,450 revolutions per minute with a fan speed of about 1,100 revolutions per minute. This class of goods should not receive more than 42 beats per inch, and for the longer staple cotton the beats per inch should be dropped to 32 to 36. If the cotton receives too many beats it is apt to put neps in and if not beaten enough, the dirt will not be taken out. The

STANDARD WEIGHT

of the finer yarn lap should be about 35 pounds, or about 12 ounces per yard. The coarser yarn lap should weigh 39 pounds, or about 14 ounces per yard. The variation from the standard weight of laps should not be more than one-half pound either way, and laps which vary more than this should be run over. The laps are put up at the card, and the draft for the finer count should not be less than 100 and the coarser one not over 100. Close settings should be used for the 60s yarn, and some overseers speed up the top flats so that a greater amount of waste will be taken out. The same wire may be used for both counts, i. e., 34s (American number) for cylinder and 35 or 36s for top flats and doffer. Use as large a doffer as possible. In the longer staples some overseers slow down the

SPEED OF THE LICKER-IN.

They say that the speed of this part is too fast for long staples, and it tends to put neps into the cotton. The weight of the sliver for the 60s yarn should be about 50 grains, and for the 16s about 65 grains per yard. The production for the finer yarn is 500 pounds per week of 60 hours, and for the coarser yarn 65 grains per yard. Strip cards three times a day, although some overseers strip the doffer four times. The sliver for the finer yarn is combed and the coarser yarn goes direct to the drawing frame. We will first follow the

COURSE OF THE COTTON

for the 60s yarn. It is first put through the sliver lap machine, the doublings being 14 into 1, the weight of the lap being 300 grains per yard. Six of these laps are put up at the ribbon lap machine, the weight of lap at front being 260 grains per yard. The laps are then put up at the comber, the doublings being generally six into one, although eight into one is sometimes used. The speed of the comber should be about 90 nips per minute, draft 29, percentage of waste taken out 18, and the weight of the sliver about 45 grains per yard. This sliver is then put through two processes of drawing, the doublings being 6 into 1. The weight of the sliver at the finisher drawing frames is 70 grains per yard. See that your drawing frames are well oiled, the top rolls being oiled twice a day, but also see that no oil gets on the leather. See that all weights are properly adjusted and the

trumpet holes the right size, also that the stop motions are all adjusted properly. The sliver is then passed to the slubber, where it is drawn into .50 hank roving. It then passes

THROUGH THREE PROCESSES

of fly frames, the hank roving at the first intermediate being 1.50, and the second 4.00 hank, and at the jack frame 13 hank. The sliver for 16s is put through three processes of drawing, the weight of sliver at the finisher drawing being 70 grains per yard, the hank roving at the slubber .50. This roving is only put through two processes of fly frames, the hank roving being made at the first about 1.50, at the second 4.00 hank. The doublings in all cases are 2 into 1. The roving is passed to the

RING SPINNING ROOM,

when it is made into 60s count. The following particulars would be used for a frame spinning this count: Gauge of spindles, 2¾ inches; diameter of ring, 1 5-16 inches; length of traverse, 5 inches; revolutions per minute of spindles, 10,000; twist per inch, 34.-68. For filling, either mule or ring frames may be used. If ring frames are employed, use the following particulars: Gauge of spindle, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6½ inches. The warp yarn is then twisted into 2-ply 60s at the twister, then spooled and put into the warper, where it is warped on beams, and from here is passed to the slasher.

Dyeing Particulars.

Following are the dyeing particulars for mercerized vesting:

Dyed mercerized yarn for spots.

RED.

Turkey red, or primuline red, primu-

6 per cent primuline red, 30 per cent

line red dyeing.

Glauber's, diazotized 1½ pounds nitrate soda, 5 pounds sulphuric acid developed, two pounds beta naphthol, well rinsed and soaped twice and rinsed in hot water.

SKY BLUE.

5 per cent immedial sky blue, 5 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's, rinse well, and give a soap bath, rinse well and dry.

NAVY BLUE.

8 per cent immedial dark blue B., 8 per cent sulphide soda, 3 per cent soda ash, 30 per cent Glauber's, rinse well, soap and rinse in hot water, and dry.

BROWN.

10 per cent thion brown G., 10 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's, rinse and soap as above blue.

DARK GREEN.

10 per cent katigen dark green 2B., 2 per cent katigen blue black B., 2 per cent katigen yellow GG., 14 per cent sodium sulphide, 30 per cent Glauber's, 3 per cent soda ash, rinse and soap as above.

OLIVE.

8 per cent pyrogene olive G., 8 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's, rinse and soap as above.

MAROON.

10 per cent immedial Bordeaux G., 10 per cent sodium sulphide, 28 per cent Glauber's, 3 per cent soda ash, rinse and soap as above.

BLACK.

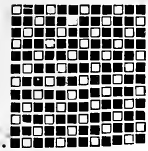
15 per cent immedial black NN., 15 per cent sodium sulphide, 30 per cent Glauber's, 3 per cent soda ash, rinse and soap as above.

JEAN

Jean is a narrow, hard-faced cotton fabric, weighing from 4 to 4½ ounces per yard, and is usually made of a hard-twisted warp yarn, about 1-20s cotton, and either a wool or a wool shoddy filling. The fabric is made with a small, uneven-sided twill weave, warp effect face, viz.: $\frac{2}{\quad 1}$ 45° twill, the cloth being of a slate black color.

Jean is used principally in the manufacture of ready-to-wear trousers, retailing at 85 cents to $1 per pair, for workmen who perform hard, rough

and dirty work, and who do not wear overalls. For this purpose it is the most serviceable fabric on the market, the garment when worn being popularly known as Kentucky jean, which has this distinct advantage, that upon



Weave

Drawing-in Draft

Reed Plan

its becoming soiled, a good washing will readily cleanse and remove all dirty marks, and apparently toughen the cloth, although causing it to shrink somewhat.

"KENTUCKY JEANS"

are worn by laborers, railroaders, moulders, machinists, loom fixers, general male mill help, etc., and with a small amount of care will wear well for two or three years.

Jean is made with one warp and one filling, and can be woven in any single box loom.

The warp yarn is generally of a cheap grade of cotton, and receives about two extra turns of twist per inch, in excess of the required amount of twist in the regular yarn of a similar count. It is this fact which causes jean as a fabric to have such a hard feel.

The filling is usually a mixture, containing about 40 per cent cotton and 60 per cent wool shoddy, the yarn being spun on the woolen principle.

The wool shoddy is made by pickering and carding dark colored woolen rags, after which the cotton and shoddy are made into a mixing of relative proportions and the lot run through the mixing picker. The stock is then carded and spun, the yarn receiving sufficient filling twist, the result being a dark colored, lofty thread, a suitable filling for this fabric jean.

The warp is dyed a rather grayish black, with cheap dry color, and the warp and filling colors combined in the weaving produce a fabric of a decidedly slate black appearance.

Jean receives a dry finish, being brushed, sheared and pressed, after which it is rolled or lapped, then packed into cases, for shipment.

CONSTRUCTION.

Reed 800—30½ inches plus 2 ends per dent, 10 per cent take-up in weaving, 36 picks 1-20s cut wool shoddy, 1-20s cotton warp.

Finish equals 27 inches.

44.4 x 30½ equals 1,354 ends plus 10 per cent equals 1,480 yards 1-20s cotton warp equals 1.41 ounces. Warp, 36 picks times 30½ equals 1,098 yards, 1-20s cut wool shoddy equals 2.92 ounces filling.

1.41 ounces warp, 2.92 ounces filling equals 4.33 ounces.

4.33 ounces weight, 27 inches wide.

Carding and Spinning Particulars.

The yarn used for this class of goods is constructed bv two entirely different systems. The filling is generally composed of a mixture of wool or wool shoddy and cotton. The filling yarn is therefore made in a woolen mill. It is understood that entirely different machines are used, and the method of mixing is entirely different from that used in a cotton mill, although the names of the machines in many instances are alike. The warp yarn is made of all-cotton stock and is therefore spun into yarn in a cotton mill, and below will be found the carding and spinning particulars for making this count of yarn of jean fabric. Of course, these may and are deviated from in many mills, but not to any great extent.

THE RAW STOCK

generally used is of a low grade and about one inch in staple. This class of yarn is spun in mills of the first division, as given in a previous lesson, and the mixing would be done by hand. The bales of cotton would be sampled, and all those of the same length put into the mixing bin. For this class of goods a small percentage of comber waste is sometimes mixed with the raw stock, and some mills use the card waste. The percentage is generally small, however. The good waste from the pickers, cards and drawing frames is always used and

mixed at this point. The raw stock is run through an opener and two processes of picking.

The hopper should always be kept full. The speed of the beater should be 1,050 revolutions per minute, and the fan 350 revolutions per minute. The speed of the breaker picker beater is about 1,500 revolutions per minute, the fan speed being 1,400 revolutions per minute.

THE WEIGHT OF LAP

at the front of this machine is about 40 pounds or 16 ounces to the yard. The doubling at the finisher picker is four into one and the speed of the beater (two-bladed rigid type) 1,450 revolutions per minute, which gives the cotton passing through it about 42 beats per inch. The speed of the fan is about 1,100 revolutions per minute. The weight of the total lap is about 39 pounds, or 14½ ounces to the yard. Clean out from under the pickers frequently, so that the fly will not collect and be drawn back into the good clean cotton passing through.

The draft of this picker should be about 2.75. The laps are then put up at

THE CARD.

This machine should not have a draft of more than 100. The doffer should be as large as possible and the wire fillet used should be No. 33 wire (American count) for cylinder and No. 34 for doffer and flats. The flats make one revolution about every 45 minutes. The cards should be stripped three times a day and ground once a month. The weight of the sliver should be 65 grains to the yard, and the production for a week of 60 hours should be between 950 and 1,000 pounds. This sliver is then run through

TWO PROCESSES

of drawing frames. The settings used at one mill for this stock and staple are as follows: Front roll to second, 1¼, second to third, 1¼, and third to back, 1½ inches. The doublings at this machine are six into one and the speed of the front roller 400 revolutions per minute. The draft at the finisher machine is about 5.75. The weight of the sliver should be about 75 grains per yard. The drawing sliver should be sized at least twice a day and four times would be much better.

The sliver is then drawn into .50 hank roving by the slubber and three processes of fly frames, the hank roving being as follows: 1.50 at the first intermediate, 3.50 at the second, and 8.00 at the jack frame. The usual care should be given to the rolls, etc., and

THE ROVING

at the jack frame should be sized once a day. The roving is then put through a warp spinning frame, the particulars being as follows: Gauge of frame, 2¾ inches; diameter of rings, two inches; length of traverse, seven inches. This yarn is hard twisted and receives about two complete turns more per inch than are usually used for cloth yarn; that is, the regular twist per inch for this count is 21.24 turns per inch, but for this cloth is 23.24. The speed of the spindle is about 9,400 revolutions per minute. This yarn is taken to the spoolers and spooled from the spools, is warped and put through the slasher. A good sizing is made as follows: Water, 100 gallons; potato starch, 70 pounds; tallow, four pounds; turpentine, one pint.

Dyeing Particulars.

DARK SLATE.

2½ pounds thion black G., 2½ pounds sulphide sodium, one pound soda ash, 20 pounds salt.

BLACK.

15 pounds thion black G., 15 pounds sulphide sodium, three pounds soda ash, 30 pounds salt.

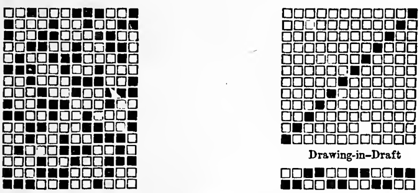
CRETONNE

Cretonne is a light-weight single cloth, all-cotton fabric, weighing from 2 to 5 ounces per yard, and composed of yarns ranging from 1-40s to 1-20s in the warp and 1-20s to 1-7s in the filling.

It is usually woven with either the plain weave $\frac{1}{\quad 1}$, $\frac{2}{\quad 2}$, twill 45 degree, or a fancy effect resembling a

granite weave, such as is used as a foundation weave in dress goods. The fabric is woven with either an all bleached or gray cotton warp and filling, the patterns being fancy stripes and allover floral effects printed in bright colors upon one side of the goods.

This gives the printed or face side of the fabric somewhat the appearance of an elaborately figured jacquard design. Those colors found most effective for this purpose are bright


Design Drawing-in-Draft Reed Plan

Harness chain same as design.

and medium shades of red, blue, green, yellow, etc., and a good jet black.

Cretonne is made in widths from 25 to 36 inches, the narrow grades being the lightest in weight.

The various grades are used for couch covers, draperies, lambrequins and comfortables or bed quilts.

THE WEAVING.

Being a one-shuttle fabric, plain weave or twilled, cretonne can be woven on the single box loom. The fancy grades in which mixed weaves are desired necessitate the use of looms with a dobby or head motion attached. The warp for cretonne, being either gray or bleached yarn, is prepared in a manner similar to that of weaving a plain ordinary sheeting.

Those grades in which the plain weave or $\frac{2}{2}$ twill weave are used are drawn in and woven upon four harnesses. If, however, a fancy weave is desired, the warp must be drawn in and woven upon a number of harnesses, in accordance with the number of ends in one repeat of weave desired.

As printing the colored pattern upon this fabric constitutes the finish thereof, the goods are taken from the loom and run through the brushing machine, to remove all dust, dirt or loose ends.

THE FIGURED PATTERN

to be produced upon the cloth has been engraved upon bronze rollers, which have been set up in the printing machine. The colors are fed automatically to the rollers, which, in revolving, register the colors upon the face of the cloth, as it passes between them. The cloth is then dried by being run through heated rollers or drums, and the fabric is then ready to be folded into suitable lengths to be packed and shipped.

Four square inches equals 7.95 grains.

29 x 36 equals 1,044 x 7.95 equals 8,-299.80 divided by 4 equals 2,074.95 divided by 437.5 equals 4.742 ounces per yard, 29 inches wide.

20 pieces white warp yarn x 2½ inches equals 50 inches equals .55 grains, 50 x 7,000 equals 350,000 divided by .55 equals 636,363 divided by 36 equals 17,399 divided by 840 equals 1-20s cotton warp yarn.

12 pieces white filling yarn times 4 inches equals 48 inches equals 1.55 grains.

48 x 7,000 equals 336,000 divided by 1.55 equals 216,774 divided by 36 equals 6,021.5 divided by 840 equals 1-7s cotton filling yarn.

15 cents per yard, 29 inches finished.

CONSTRUCTION.

Reed, 900 minus 30 1-3 inches minus 2 ends per dent, 52 ends per inch finished, 40 picks per inch finished equals 50 ends in reed, 38 picks in loom, 10 per cent take-up in weaving.

52 x 29 equals 1,508 plus 10 per cent equals 1,675 yards 1-20s cotton warp yarn, 40 x 29 equals 1,160 yards 1-7s cotton filling yarn, 1,675 yards, 1-20s cotton warp equals 1,595 ounces, 1,160 yards, 1-7s cotton filling equals 3.156 ounces equals 4.751 ounces.

10 cents per yard, 25¼ inches quality $\frac{2}{2}$ twill, four square inches equals 3.9 grains.

25¼ x 36 equals 909 x 3.9 equals 3545.1 divided by 4 equals 886.2 divided by 437.5 equals 2.025 ounces per yard, 25¼ inches wide.

Carding and Spinning Particulars.

The division of mills making cretonnes would be the second (or those mills equipped with machinery for making yarns the counts of which vary from 20s to 80s). The counts of yarn used for cretonne vary from 1-20s to 1-40s warp and from 1-7s to 1-20s filling, according to the quality of cretonne required. In speaking of the second division of mills we do not mean to say that the count of yarn is always within these limits, but that when buying machinery, the specifications for the different machines are made out according to whether the machines are to use low, medium or a fine grade of raw stock. Of course, it often happens that yarns of a lower or higher count are made on this machinery, but the great bulk of the yarns turned off are within the limits. For example, take cretonne: All grades of cretonne may be made in the same mill, although the count of the yarn varies from 7s to 40s, or in some cases even a finer yarn than this is used. For this article we will consider that the filling yarn is 1-20s and the warp yarn is 1-40s. The length of staple used would be from 1 1-16 to 1⅛ inches of a medium grade of cotton. The bales of raw stock would first be sampled and several bales of practically the same length of staple placed around the bale breaker and fed to this machine in small portions alternately from each bale. In this manner it is mixed better than if one entire bale was fed.

If a bale breaker is not used the method would be just the same except that it would be done by hand. The lower count would use cotton of a length of 1 inch and the higher count 1⅛ inches. Both cottons would be put through an opener and two processes of picking. Keep your hopper of the opener well filled (over half full). The speed of the beater for both grades of cotton should be about 1,050 revolutions per minute; the speed of the fan about 350 revolutions per minute. See that your pin roller is always clean, because if the cotton is allowed to accumulate, it cannot perform its duty properly. The cotton is fed to the feed rolls of the breaker beater and passed on to the beater, the speed of which should be about 1,050 revolutions per minute; a rigid two-bladed type. The total weight of the lap at the front should be about 40 pounds, or 16 ounces to the yard for both cottons. The laps are doubled at the finisher picker four into one, the cut roving being mixed in at this point in the proportion of three laps of raw stock to one of bobbin waste. The speed of the beater should be about 1,450 revolutions per minute with a fan speed of 1,100 revolutions per minute. This gives the cotton passing through about 42 beats per inch. See that the grid bars under the beaters are properly set. The total weight of the lap at the front should be 39 pounds for the shorter staple cotton and 35 pounds for the longer, or a 14-ounce lap for the 1-inch staple and 12½-ounce lap for the 1⅛-inch staple cotton.

Keep the picker room clean and always calculate to have enough laps of each kind of cotton ahead so that if breakdowns occur the cards will not be stopped for want of laps. The draft of the finisher picker is about 3. The cards should be set as before described in a previous lesson, except that the feed plate should be set to the licker-in, according to the length of the staple. Cards should be stripped three times a day and ground at least once a month. The wire fillet should be made of 34 wire (or 110s English count) for cylinder and 35 (or 120s English count) for doffer and flats. Use as large a doffer as possible, say 26 inches at least. The draft of the card should be about 100 for both stocks. The weight of the sliver at the front of the card should be about 65 grains. The production should be 825 pounds for the shorter staple and 600 pounds for the longer one for a week of 60 hours. The card sliver is next put through three processes of drawing frames. A few of the more particular points to look out for are, scour the frames at least once a month, keep your leather top rolls in perfect condition and well oiled and varnished. See that all knock-off motions are in working order to prevent single and double; keep the weight of

your sliver uniform by sizing it at least twice a day and three times a day for fine yarns, doubling six into one at all frames. The weight of the sliver at the finisher drawing should be about 70 grains per yard. The drawing sliver is drawn into .50 hank roving at the slubber, the standard twist being found by multiplying the square root of hank by 1. The roving for the 20s yarn goes through two processes of fly frames, the hank at the first intermediate being 2 and at the second 5 hank. The 40s yarn roving is put through three processes, the hank roving at each process being as follows: first, 1.50; second, 3.50, and third, 9 to 9.50 hank, the doublings at all frames being two into one. The sliver is then passed to the spinning room. In case the filling yarn is spun on a ring frame the following would be good particulars for the frame spinning 20s: Gauge of frame 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6½ inches; speed of spindle, 7,300 revolutions per minute; twist per inch, 14.50; and for a warp frame spinning 40s: gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 6½ inches; twist, 28.45. The warp yarn is then spooled, warped and run through a slasher.

Dyeing Particulars.

RED.

5 per cent benzo fast red 4 BS., 30 per cent Glauber's, 3 per cent soda.

YELLOW.

2 per cent chrysophenine, 30 per cent Glauber's, 2 per cent sal soda.

LIGHT BLUE.

1 per cent diamine sky blue FF., 30 per cent Glauber's, 1 per cent sal soda.

LIGHT GREEN.

1 per cent diamine fast yellow FF., 1 per cent diamine sky blue PF., 30 per cent Glauber's, 3 per cent sal soda.

ORANGE.

2 per cent tetrazo orange CR., 30 per cent Glauber's, 1 per cent sal soda.

MAROON.

3 per cent tetrazo corinth G., 30 per cent Glauber's, 2 per cent sal soda.

HELIOTROPE.

3 per cent heliotrope BB., 30 per cent Glauber's, 2 per cent sal soda. On a tannin and tartar emetic mordant dye the four following shades:

MALACHITE GREEN.

2 per cent malachite green; also for

MEDIUM BLUE.

2 per cent methylene blue.

PINK.

1 per cent rhodamine 5G.

PURPLE.

1 per cent methyl violet 3B.

BLACK.

15 per cent thion black G., 15 per cent sulphide sodium, 5 per cent soda ash, 30 per cent salt.

SLATE.

2 per cent thion black G., 2 per cent sulphide sodium, 2 per cent soda ash, 30 per cent salt.

LIGHT BROWN.

8 per cent thion brown G., 8 per cent sulphide sodium, 3 per cent soda ash, 30 per cent salt.

DARK BROWN.

12 per cent thion brown G., ½ per cent thion black G., 12 per cent sodium sulphide, 3 per cent soda ash, 30 per cent salt.

Cretonnes are also printed with very large picture designs of very bright colors, of very strong contrast, generally. Some styles are of a simple character with small flowers and twigs on a white or cream-colored ground. Other styles are of startling reds and other bright colors, on a dark brown, maroon or black ground, or on any dark colored ground to make a contrast.

The colors are printed with fast alizarine or tannin colors, which will be fast to sunlight and washing. Brightness of shade is required in most cases.

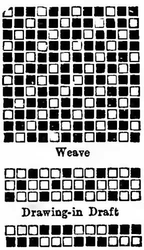
SILESIA

Silesia is a light-weight single cloth fabric, having a rather high texture, and weighing about three ounces per yard. It is composed of all cotton

yarns 1-30s to 1-40s in warp and filling and is usually made with a $\frac{2}{1}$ 45 degree right-hand twill weave. It is used principally as a lining for ladies' and men's clothing. A

VERY IMPORTANT FEATURE

in connection with this fabric is the highly glazed or polished face of the goods, which is due to the action of



Weave

Drawing-in Draft

Reed Plan

the heated roller in the calendering machine upon the sizing, which the goods have absorbed in the process of finishing, just previous to the calendering operation.

One of the most important features in obtaining the highly glazed surface on many of these lining fabrics is the use of a special kind of calender roll when the fabrics are being finished. This calender roll contains very small fine lines which are impressed into the fabric, and which is usually known as milling. The reason this process creates a luster is because the fine lines create more surfaces in the fabric, and reflect the light in a better manner. By examining many of these cloths with a magnifying glass the very fine lines can be seen clearly impressed upon the various strands of yarn which form the fabric.

Silesia is woven of yarn in the gray state and is dyed in the piece, in such colors as black, dark blue, brown, slate, drab, steel, etc. It is woven on any single box loom.

The warp is made upon a warping mill, and beamed upon a slasher. It is then ready to be drawn in on cotton harness, and woven in a manner similar to a drill.

The goods are taken from the loom and brushed, then run through a solution of soap and cold water to remove all dirt, after which they are rinsed in cold water.

The goods are now dyed in the piece, after which they are sized, then tentered to keep from shrinking in width, also to dry the cloth. After tentering, the goods are run through the calender to produce the smooth, glazed finish upon the face of the cloth. The finished fabric is then ready to prepare for packing and shipping.

Four square inches equals 5.4 grains.

27 x 36 equals 972 x 5.4 equals 5.248.8 divided by 4 equals 1,312.2 divided by 437.5 equals three ounces per yard, 27 inches wide finished.

24 pieces warp yarn times 1½ inches equals 36 inches equals .3 grains; 36 x 7,000 equals 252,000 divided by .3 equals 840,000 divided by 36 equals 23,333 divided by 840 equals 1-28s warp.

30 pieces filling yarn times 1½ inches equals 45 inches equals .33 grains; 45 x 7,000 equals 315,000 divided by .33 equals 924,242 divided by 36 equals 25,673 divided by 840 equals 1-30s filling.

CONSTRUCTION.

Reed, 1,012 minus 28.7 inches in reed minus three ends per dent, 90 ends per inch finished and 72 picks per inch finished, equals 86 ends in reed and 69 picks in loom.

10 per cent take-up on warp in weaving 6 per cent size on warp in weaving.

1-28s cotton warp, 1-30s cotton filling.

Color—slate or drab.

90 x 27 equals 2,430 plus 10 per cent equals 2,700 yards 1-28s cotton warp, 72 x 27 equals 1,944 yards 1-30s cotton filling.

2,700 yards 1-28s cotton warp equals 1.837 ounces, 1,944 yards 1-30s cotton filling equals 1.234 ounces, equals 3.071 ounces.

Finish equals brush and calender.

Carding and Spinning Particulars.

The yarns used in making silesia vary from 30s to 40s. These counts of yarn would be made in a mill of the second division, as given in a previous lesson. Mills making this class of goods are now generally equipped with a bale breaker. After the cotton is stapled and the bales sorted out, according to the length of staple and grade of cotton, several bales are placed around the bale breaker and the cotton fed to this machine alternately from each bale. By this method the cotton is more thoroughly mixed than if a whole bale was fed to the machine at once. The cotton is then dropped on an endless lattice and carried to its proper bin. This latter is generally movable in either direction so that it may be placed in position to drop the cotton into its proper bin. The mixings should be as large as possible and cotton of a fair grade having a staple of 1⅛ inches for this class of goods. The mixings should be allowed to stand as long as possible and the good waste from the pickers, cards, drawing frames and back of slubber should be mixed in at this place. The waste from the above machines is collected at regular intervals, and may be mixed as fast as collected. Little system is used in mixing the waste into the raw stock, but the picker room boss should watch to see that the waste man keeps the different lengths of staples, kinds and grades of cotton by themselves. Otherwise trouble is bound to occur at the latter machines. The raw stock is put through an opener, and sometimes three but more often

TWO PROCESSES OF PICKING.

The hopper of the opener is filled with cotton and started up and should be kept well filled all the time it is in motion. The speed of the beater of this machine for this class of goods should be 1,050 revolutions per minute with a fan speed of 350 revolutions per minute. Keep your bin beater clean, and see that it is adjusted to the proper distance from the lifting apron, so that the correct amount of cotton will be fed to the breaker picker. The total weight of the laps for both the warps and filling yarn should be about 40 pounds or 16 ounces to yard of lap. These laps are put up at the finisher picker and doubled four into one. The speed of the beater is 1,450 revolutions per minute, with a fair speed of 1,100 revolutions per minute. This gives the cotton about 42 beats per inch of cotton fed. The beats per inch given to cotton do not vary much on all classes of cotton, except in the case of Sea Island, of a long staple. In the latter case the speed of the beater is slowed down so that the cotton receives from 29 to 34 beats per inch The total weight of the lap at the front end of the finisher is 35 pounds or 12½ ounces to yard of lap. The

BOBBIN WASTE COTTON

is mixed at this point, it first having gone through an extra process to take out the twist. This waste is made into a lap and then put up at the finisher picker and mixed in proportions of three laps of raw stock to one lap of bobbin waste. The draughts of the picker should be looked after to see that the currents of air are properly directed so as to obtain the best advantage in making an even, firm lap that will not lick up at the card. Too much waste in the mixing will also tend to make a lap split or lick up at the card.

THE CARD

should have a draft of not less than 100. The settings should be the sam as given in a previous lesson and the cylinder and doffer stripped three times a day. The cylinder and doffer should be ground once a month and the flats about once in every three weeks. The weight of the sliver at the front should be about 65 grains per yard. Use the same count of wire for cylinder and doffer as given in the last article.

The card sliver is put through three processes of drawing. In some mills the cotton is put through a railway head. This machine doubles from 8 to 16 ends, and this at the front passes through a trumpet, which automatically evens it. When this process is used, one process of drawing frames

is left out. The weight of the sliver at the front of the finisher drawing should be about 70 grains per yard. See that your leather top rolls are well varnished and otherwise in perfect condition. The following directions will be found excellent for making the varnish to use on the rolls: three ounces glue (use a gelatin fish glue), one ounce of acid (acetic). Let this dissolve and then add color and 10 or 12 drops of oil of origanum. In warm weather a little borax may be added. The sliver is taken from the drawing frame and run through the slubber, where it is made into a .50 hank roving. The

SLUBBER ROVING

is then put through three processes of fly frames for both warp and filling yarns, the hank roving being as follows: First intermediate, 1.50; second intermediate, 4 and 7.50 hank at the jack frame for the warp yarn and 8. for the filling yarn. See that your fly frame rolls are spread to the proper distance and look out for the shape of your full bobbins to see that the taper of the ends is neither too blunt nor too sharp. If the former, it is liable to run over both on the frame and in handling, and if the latter, only a small amount of roving can be wound on each bobbin. The warp yarn is spun in the ring spinning frame, but the filling yarn may be either spun on a ring frame or a mule, but is generally done on the former machine. The particulars for a warp frame spinning 36s yarn has already been given in a previous lesson. Those used for a filling frame spinning 40s are as follows: Gauge of spindles, 2¾ inches; diameter of ring, 1 5-16 inches; length of traverse, 5½ inches; speed of spindle, 8,800 revolutions per minute; twist per inch, 23.72. The warp yarn is then spooled, warped and put through a slasher.

Dyeing Particulars.

Silesias are dyed on the jig machine at the full width of the piece.

CREAM.

A few grains of fast cotton yellow C. Ex., 5 pounds Glauber's, one-half pound sal soda.

LIGHT ECRU.

1-16 ounce fast cotton yellow C. Ex., 1-16-ounce, direct orange TG.

ECRU.

1-16 ounce fast cotton yellow C. Ex., 1¼ ounces fast cotton brown G., 5 pounds Glauber's, ½ pound sal soda.

LIGHT SLATE.

2 ounces fast cotton yellow C. Ex., 4 ounces direct black S., 5 pounds Glauber's, ½ pound sal soda.

SLATE.

1 pound direct black S., 4 ounces fast cotton yellow C. Ex., 10 pounds Glauber's, 1 pound sal soda.

DARK SLATE.

2 pounds diamine black BH., 4 ounces diamine fast yellow A., 4 ounces oxydiamine black A., 20 pounds Glauber's, 2 pounds sal soda.

LIGHT DRAB.

4 ounces diamine fast yellow A., 4 ounces diamine brown B., 4 ounces diamine black BH., 10 pounds Glauber's, 2 pounds sal soda.

DRAB.

½ pound diamine fast yellow A. ½ pound diamine black BH., 6 ounces diamine brown B., 10 pounds Glauber's, two pounds sal soda.

LIGHT TAN.

½ pound diamine fast yellow A., ½ pound diamineral brown G., 10 pounds Glauber's, two pounds sal soda.

TAN.

2 pounds diamine catechine 3 G., 1 pound diamine fast yellow B., 10 pounds Glauber's, 2 pounds sal soda.

OLD GOLD.

3 pounds diamine fast yellow B., 2 pounds diamine catechine 3 G., ½ ounce diamine black BH., 10 pounds Glauber's, 2 pounds sal soda.

PEARL.

1-16 ounce diamine brilliant blue G., 5 pounds Glauber's, 1 pound sal soda, after-treated ¼ per cent copper sulphate.

SKY BLUE.

6 ounces diamine sky blue FF., 5 pounds Glauber's, ½ pound sal soda.

BLUE.

2 pounds diamine blue RW., 5 pounds Glauber's, ½ pound sal soda.

RED.

6 per cent primuline, 25 per cent Glauber's, 3 per cent sal soda.

Diazotized 1½ per cent nitrate soda 5 per cent sulphuric acid. Developed two pounds beta naphthol.

SCARLET.

4 pounds benzo fast scarlet 4 BS., 30 pounds Glauber's, 3 pounds sal soda.

MAROON.

5 pounds tetrazo corinth B., 30 pounds Glauber's, 3 pounds sal soda.

HELIOTROPE.

½ pound heliotrope BB., 10 pounds Glauber's, ½ pound sal soda.

PINK.

½ pound tetrazo pink BU., 20 pounds Glauber's ½ pound sal soda.

YELLOW.

1½ pounds chlorine yellow GG., 20 pounds Glauber's, 2 pounds sal soda.

ORANGE.

2 pounds benzo fast orange S., 30 pounds Glauber's, 3 pounds sal soda.

DARK GREEN.

3 per cent benzo dark green GG., 2 per cent chrysophenine, 1 per cent direct black B.

GREEN.

3 per cent brilliant benzo green B., ½ per cent chrysophenine, 30 per cent Glauber's, 3 per cent sal soda.

NAVY BLUE.

5 per cent diazo black BHN., 30 per cent Glauber's, 3 per cent sal soda.

LIGHT BROWN.

6 per cent thion brown G., 6 per cent sodium sulphide, 30 per cent Glauber's, 3 per cent soda ash.

BROWN.

6 per cent diamine brown B., 1 per cent diamine yellow B., 1 per cent diamine catechine G., 30 per cent Glauber's, 3 per cent sal soda.

DARK BROWN.

2 per cent benzo fast black, 2½ per cent benzo fast red L., 4 per cent chrysophenine, 30 per cent Glauber's, 3 per cent sal soda.

BLACK.

15 per cent thion black B., 15 per cent sodium sulphide, 3 per cent soda ash, 30 per cent Glauber's.

LAWN

Lawn is a light-weight, single cloth wash fabric, weighing from 1¼ to 2¼ ounces per yard and in different widths finished. It is composed of all cotton yarns from 1-40s to about 1-100s, and is always woven with a plain weave $\frac{1}{1}$.

PLAIN LAWN

is made of grey yarn in both the warp and filling. The fancier grades, or those having a color effect, are produced by printing vines, floral stripes, small flowers, etc., in bright colors in scattered effects upon the face of the goods, the warp and the filling in all cases being grey yarns. The patterns are always printed, never woven.

Lawn is made in various grades, ranging in price from 5 to 12½ and 15 cents per yard, and it is used principally in the manufacture of ladies' and children's summer dresses, sash curtains, etc. Being a rather sheer fabric, lawn is best adapted to those light running looms in which the action of shedding is easiest upon the fine yarns used in this style of goods.

The warp for this fabric is warped upon an ordinary warper and the various beams placed upon the slasher, the yarn being sized just about the same as is noted for an ordinary sheeting, though, of course, different sizing compounds and a greater amount of care is necessary, due to the fine yarn sizes used. It is never a very successful policy to use bleached yarns in any of the finer numbers, in fact, it is probable that no domestic concern uses single bleached or dyed yarns of a finer size than 70s-1. It is more economical to use grey yarns, and in most cases it gives a

much better result, and besides cloths are practical when made from grey yarns when they would be impractical in bleached and dyed yarns. The method of making any fabric depends a good deal on the result desired, and it is the adoption of the

CORRECT METHOD

which brings success in a great many instances. Curtain mills have adopted the automatic loom for some of the fabrics which they produce, and because of this reason they are earning quite large dividends. Other mills have adopted fast colors and are now piece bleaching their product instead of using bleached and dyed yarns, and are thus obtaining a greater margin of profit than others making similar cloths. Other illustrations might be given of a similar character, but intelligence should be used if successful results are to be secured. Lawns are practically always woven upon light looms, and very few have ever been woven upon automatic machines. This has resulted because fine yarns are likely to break more extensively and because the weight of the heddles upon the fine yarn causes breakage and loss of production. The number of looms per weaver is therefore reduced, and the possibility of saving decidedly less. In order for automatic looms to be successful they must be kept in operation, and fine yarn does not allow this as extensively as medium and coarse sizes.

The plain weave requires but two harnesses, but where there are a great number of ends in the warp, the yarn would be very much crowded if the warp was drawn in on two harnesses. Therefore, four or more harnesses are used.

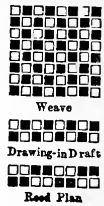
Lawn, when finished, should have a very soft, smooth feel. Therefore the finishing process includes brushing, very light starching or sizing, then calendering or pressing.

16 square inches equals 6.9 grains.

40 x 36 equals 1,440 x 6.9 equals 9,936 divided by 16 equals 621 divided by 437.5 equals 1.419 ounces per yard, 40 inches wide finished.

40 pieces white warp yarn x 3½ inches equals 140 inches equals .5 grains.

140 x 7,000 equals 980,000 divided by .5 equals 1,960,000 divided by 36 equals 54,444 divided by 840 equals 1-66s cotton warp.



46 pieces white filling yarn x 2½ inches equals 100 equals .35 grains.

100 x 7,000 equals 700,000 divided by .35 equals 2,000,000 divided by 36 equals 55,555 divided by 840 equals 1-66s cotton filling.

CONSTRUCTION.

40 inches finished.

64 ends per inch finished, 62 picks per inch finished equals 60 ends in reed and 58 picks in loom.

Reed, 1,080; 42¾ inches in reed. 2 ends per dent.

5 per cent take-up on warp in weaving.

64@40 equals 2,560 ends plus 5 per cent take-up equals 2,694 yards.

62 picks x 40 inches equals 2,480 yards.

2,694 yards, 1-66s cotton warp equals .748 ounces; 2,480 yards, 1-66s cotton filling equals .712 ounces total, 1.460 ounces.

Carding and Spinning Particulars.

The counts of yarns from which lawn is made vary according to the quality of lawn being made. This varies from 40s to 100s. The yarns are made in the third division of mills, as given in a previous lesson or those mills which make high count yarns. In this article we will consider the warp yarn to be 60s and the filling yarn to be 100s. For these two counts raw stock of two different lengths of staple and grade of yarn would be used. For 100s a Sea Island cotton of about 1 7-16-inch staple may be used

and for the warp yarn an Allen cotton of about 1⅜-inches staple. The two cottons would be treated differently at every process, and so we will describe the two cottons at each process. The Allen cotton would be put through the bale breaker in the manner described in the article of last week, and carried to its proper bin. At this point the

GOOD WASTE IS MIXED IN.

It is not the general custom to run the Sea Island cotton through the bale breaker, but to mix it by hand great care should be taken that all the bales mixed are of a uniform length and that the grade of each bale is up to standard. Those bales not up to standard should be shipped back to the broker. The good waste is mixed in at this point, but be sure that the waste boy only puts in Sea Island cotton, for if a shorter staple cotton gets in it will cause trouble at subsequent machines. The Allen cotton is put through two processes of picking and an opener. For this class of cotton three processes of picking would be better for, as it is a very dirty cotton, the extra picking would help to clean it. The speeds of all the picking machines previously given may be used for this cotton. The weight of the lap at the breaker picker should be about 40 pounds or a 16-ounce lap. The doublings are four into one at the finisher, the total weight being 3.5 pounds or a 12-ounce lap. If an intermediate picker is used, the total weight of the lap should be about 37 pounds or a 12-ounce lap. The

SEA ISLAND COTTON

is only put through an opener and one process of picking, the reason for this being that the staple is so long that if two processes are used the extra beating that it receives tends to put neps into the staple. The speeds of the opener are slowed down and the speeds of the finisher parts are as follows: The speed of a rigid two-bladed beater should not exceed 1.000 revolutions per minute. The total weight of the lap should be about 30 pounds or about a 9-ounce lap to the yard. The roving waste should be mixed in at the finisher picker process, as previously explained. The cards should be set close for both cottons, the main difference being in the setting of the feed roller to the licker-in, which should be set according to the length of staple. The usual points that have been given in previous lessons should be looked out for when running Allen cotton, the weight of the sliver in front being 65 grains to the yard and the production being about 500 pounds for a week of 60 hours, the draft being not less than 100. For Sea Island

ADDITIONAL CARE

has to be taken; also certain speeds have to be altered. It has been found that by slowing the speed of the licker-in less neps are put into the cotton and still the cotton is cleaned. In fact, one overseer using this class of cotton lagged his licker-in pulley so as to obtain an extra diameter of 1½ inches and found the results excellent, the sliver showing fewer neps than when the usual speed of the licker-in was used. On this cotton it is the general practice to use high drafts and sometimes a draft of 165 is used, but for general purposes a draft of about 130 is used. The flats are speeded so as to make one complete revolution every 45 minutes, the extra speed being obtained by lagging the pulley on the cylinder that drives the flats. This, of course, takes out more waste, but it makes less work for the combers to do. The weight of the sliver at the card is about 45 grains per yard. Strip and grind cards the same as stated in previous articles.

THE WIRE FILLET

used for cards making sliver for high class yarns is generally firmer than that previously given and if cards are used for high count yarn the size of the fillet should be as follows: Cylinder No. 34 wire or 110s English count; doffer and top flats, No. 36 wire or 130s English count. The production of a card on Sea Island cotton varies from 325 to 450 pounds per week of 60 hours. Four hundred pounds is a good average. From the cards both cottons are taken to the comber room and the doublings at the sliver lap are 14 into one. The weight of the Allen lap at the front is 320 grains per yard and the Sea Island weighs 250 grains per

yard. The cottons are then put through the ribbon lap machine, where the Allen is doubled 6 into one, but it is the general custom to double the Sea Island only 5 into one, the weight of lap at the front end being 260 grains per yard for Allen and 200 grains for Sea Island. The laps are taken to the combers, where they are doubled 6 into one. The speed of the combers should be about 85 to 90 neps per minute for Allen and 75 to 80 for Sea Island. The amount of waste taken out at the comber is important. A good average for Allen is 18 per cent and for Sea Island 20 to 25 per cent. The

WEIGHT OF THE SLIVER

for Allen is about 42 and for Sea Island about 36 grains per yard. After passing through the comber the sliver is put through two processes of drawing, the weight of the sliver at the front being 60 grains per yard for Sea Island and 70 grains for Allen. On all machines when leather top rolls are used for Sea Island, stock should be kept in the best of shape and oiled and varnished frequently. The speed of the front roll on the finisher drawing for Sea Island should be about 320 revolutions per minute or 80 revolutions per minute slower than for Allen. The slubber draws the sliver into .50 hank roving for Allen and .80 hank for Sea Island. The Sea Island is put through three processes of fly frames, the hank roving being as follows: First intermediate, 2.25; second intermediate, 5.00; jack frame, 18 hank, and for Allen: First intermediate, 1.50; second intermediate, 4.00; jack frame, 12 hank. The twist per inch put into Sea Island cotton is a little less than the usual amount used for other cottons, the standard for jack frames being square root of hank x 1.2. The filling yarn is mule spun and the warp yarn ring spun, the following particulars being used: Gauge of frame, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6 inches; speed of spindle, 10,000 revolutions per minute; twist per inch, 34.86. The warp yarn is then taken to the spoolers and from here to the warpers, where it is run on beams and taken to the slasher. The following is a good size to use: 100 gallons water, 54 pounds potato starch, 2 pounds Yorkshire gum, 1½ pounds soap.

Finishing Particulars.

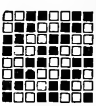
Lawns have to be very carefully handled in the bleaching process. They are starched with an ordinary starch mangle with from 8 to 12 ounces best white German dextrine per gallon, mixed cold, and boiled for one hour, with a little blueing added to shade required.

They are then finished on the stenter machine, dryed with hot air, care being taken to keep the pieces perfectly straight.

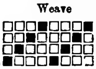
Lawns are often tinted light shades of blue, pink, cream, ecru, pearl, green and other light tints with direct colors added to the starch, the direct colors being used generally. The basic and acid colors are also tinted to make bright colors.

TARTAN PLAIDS

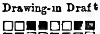
Tartan plaid is a narrow, lightweight, single cloth fabric, weighing from 2 to 2¼ ounces per yard finished, and is composed of regular cotton yarns from 1-20s to 1-26s in warp and



Weave



Drawing-in Draft



Reed Plan

filling. It is always woven about 23½ inches in the reed, to finish about 22 inches wide. This is done to prevent it from coming too close to the gingham lines.

Tartan plaids are generally woven with a $\frac{2}{2}$ 45 degree, right hand twill weave, and are always woven in plaid patterns in imitation of the imported worsted fabric of this name.

Each line of patterns has a standard name, which represents a signifi-

cant style of color arrangement, such as Rob Roy, dress Stewart, Royal Stewart, Malcolm, Fraser, McGregor, Sinclair, Gordon, Drummond, Macpherson, etc.

Those colors most used are red, green, black, white, brown, drab, wine, dark green, scarlet, dark blue, etc.

IN THE ROB ROY STYLE

the pattern takes the form of a broad, two-colored check, 1¼ x 1¼ inches, either black and red, or black and white, viz.: 72 black, 72 red in warp and filling. The dress Stewart pattern is composed principally of white yarn. The Royal Stewart has a decided red color effect, the Gordon pattern a very green color effect, etc.

Aniline colors are used in dyeing the yarns for this fabric, the warp yarns being given an extra run, to insure an even shade, which, while not being exactly a fast color, is strong enough to withstand the action of a rather wet finish (gingham finish).

The warps for this fabric are ordered from the spinner in lengths of either 720, 1,080, 1,200 or 1,500 yards, and have either 1,000, 1,200, 1,400 or 2,000 ends in them.

The most popular are 720, or 1,080 yards and 1,400 ends.

The warp is dyed in bulk and the necessary number of ends of each color are then split off. When all the colors have been split or separated, the splittings, or separated bunches of ends of each color, are assembled in the beaming frame, and the yarn is arranged as per pattern in the rathe comb, and the warp run through this rathe onto the beam. After beaming the warp is drawn in in the regular manner.

To finish this fabric, the goods are taken from the loom and run through the brusher, then through the sprinkler, after which they are very lightly sized, then run upon the tentering machine to prevent undue shrinkage in width, also to assist in drying, then calendered, but not to a glossy finish.

CONSTRUCTION.

Style— Rob Roy—finished 22 inches wide; reed, 1,080—23½ inches in reed, two ends per dent; 1-26s cotton warp —10 per cent take-up; 1-22s cotton filling—40 picks; $\frac{2}{\quad 2}$, 45 degree, right-hand twill weave, 16 ends extra for selvage.

Warp pattern: 72 black x 72 reed, total 144, all equal 9 patterns plus 112 ends.

1,424 ends in warp (including selvage.)

Start 29 red at x, end 28 red at x.

704 ends black plus 10 per cent equals 780 yards 1-26s warp equals .5715 ounce; 720 ends red plus 10 per cent equals 800 yards 1-6s warp equals .5860 ounce; 48 picks times 23½ equals 564 yards, 1-22s filling equals .488 ounce and 564 yards, 1-22s filling equals .488 ounce, equals 2.1335 ounces. 2.1335 ounces per yard, 22 inches wide.

Finish—very light size, tenter, calender.

Carding and Spinning Particulars.

The yarns used in the manufacture of tartan plaids are made in mills of the first and second division, as given in a previous lesson. The counts of yarn vary according to the mill in which they are made, and the counts taken as examples for this article are 1-22s filling yarn and 1-26s warp yarn. The cotton used for these goods is of a fair grade and a staple varying from ⅞ inch to 1 1-16 inches. We will consider the staple to be one inch. The cotton is stapled and put through a bale breaker and from here is passed by a series of lattice aprons to the mixing bin. Use as large a mixing as possible at one time, because the less mixings the evener the yarn will be. The good waste from the machines up to the slubber is mixed into the raw stock at this point, the collections of this waste being made at regular intervals. The raw stock is sometimes put through

TWO PROCESSES OF PICKING

and an opener and sometimes through three processes of picking and an opener. It has been found that two processes of picking will clean the cotton properly, and at the same time will not be so apt to put neps into it. When two processes of pickings are used, the particulars of the intermedi-

ate picker given below may be dropped, the other particulars remaining the same as given. The hopper or feed box of the opener should always be kept at least half full and generally a porcupine beater is used. The speed of this beater should be about 1,050 revolutions per minute, with a fan speed of 350 revolutions per minute. The cotton is then passed to the feed rolls of the breaker picker. Keep the pin beater of this machine free from cotton, as it has to be watched to see that the sliver waste does not tangle around it. This roll is more troublesome on some makes of machines than on others. The

SPEED OF THE BEATER

(which generally is of a two-bladed rigid type) is 1,500 revolutions per minute, the fan speed being 1,400 revolutions per minute. The weight of the lap at the front should be about 40 pounds total weight or a 16-ounce lap. Some system of marking has to be employed, so that the laps of other grades and lengths of staple will not become mixed and thus cause trouble later on. Of course, like staples and weights of laps may be placed together, but it is the general custom to mark the laps at the end as they are taken off the machine with different colored crayons. For example, 1 1-16 may be marked brown, 1⅛ blue, 1 1-16 salmon, etc. This is not generally done at any except the finisher picker. The laps are doubled four into one at the intermediate picker, the speed of the beater being 1,450 revolutions per minute, and the speed of the fan 1,050 revolutions per minute. The weight of the lap at the front is about 37 pounds. These laps are put up at the finisher picker and doubled four into one. It is at this point that

THE ROVING WASTE

is mixed in in a proportion of one lap of roving waste to three laps of raw stock. The cotton receives about 42 beats per inch fed. The total weight of the lap is about 39 pounds, or about a 16-ounce per yard lap. The speed of the beater is about 1,500 revolutions per minute, and the speed of the fan 1,100 revolutions per minute. The laps are then put up at the card. The card is set to accommodate this stock as described in a previous lesson, the speed of cylinder being 160 revolutions per minute. The speed of the licker-in is 300 revolutions per minute. Flats make one complete revolution every 40 minutes. The draft should not exceed 100. Use a large diameter doffer.

Strip three times daily and grind at least once a month. The weight of the sliver is 65 grains per yard. The production is about 900 pounds per week of 60 hours. The sliver is then put through three processes of drawing, being doubled six into one, the speed of the front roller being 400 revolutions per minute, the weight of drawing at the finisher being 70 grains. Some of the points that are to be looked out for are as follows: Stop motions, rolls, laps and oiling. The sliver is next taken to the slubber and made into .40 hank roving, the usual standard for twist being used. Look out for the shape of your bobbins. The slubber roving is put through three processes of fly frames, doubling two into one. The hank roving at the first intermediate is 1.10, at the second 2.70 hank and at the jack frame five hank.

The rovings are then taken to the spinning room and made into the required yarn.

THE FILLING YARN

may be taken to either the mule or ring spinning room. If taken to the ring spinning room, the following are good particulars to use for frame making 22s yarn: Gauge of frame, 2¾; diameter of ring, 1½ inches; length of traverse, 6½ inches; twist per inch, 15.25; speed of spindles, 7,400 revolutions per minute. For a warp frame spinning 26s use gauge of frame, 2¾ inches; diameter of ring, 1¾ inches; length of traverse, 6 inches; speed of spindles, 9,700 revolutions per minute. The warp yarn is then spooled, warped and put through a slasher.

Dyeing Particulars.

RED.

4 per cent diamine fast red F., 30 per cent Glauber's, 3 per cent sal soda.

GREEN.

1½ per cent diamine sky blue FF., ½ per cent diamine fast yellow FF., 0 per cent Glauber's, 3 per cent sal soda.

BLACK.

15 per cent thion black G., 15 per cent sulphide soda, 30 per cent salt; 3 per cent soda ash.

BROWN.

5 per cent benzo fast orange S., 2 per cent chrysophenine, 2½ per cent benzo fast black, 30 per cent salt, 2 per cent soda ash.

DRAB.

¾ per cent benzo fast black, ½ per cent chrysophenine, 3 ounces benzo fast red GL., 30 per cent Glauber's, 2 per cent sal soda.

SLATE.

½ per cent benzo fast black, ¼ ounce chrysophenine, ¼ ounce benzo fast red GL., 30 per cent Glauber's, 2 per cent sal soda.

SCARLET.

5 per cent diamine scarlet B., 30 per cent Glauber's, 2 per cent sal soda.

DARK GREEN.

6 per cent diamine black HW., 4 per cent diamine fast yellow B., 30 per cent Glauber's, 2 per cent sal soda.

WINE.

6 per cent diamine Bordeaux B., 30 per cent Glauber's 3 per cent sal soda.

BLUE.

4 per cent brilliant benzo blue 6 B., 30 per cent Glauber's, 3 per cent sal soda.

DARK BLUE.

15 per cent pyrogene indigo B., 15 per cent sodium sulphide, 30 per cent salt, 3 per cent soda ash, 2 pints mineral oil.

YELLOW.

2 per cent chloramine yellow M., 30 per cent Glauber's, 2 per cent soda ash.

BAYADERE

Bayadere is a fabric in which the pattern consists of a stripe running across the width instead of the length of the material. Such patterns are almost entirely confined to ladies' and children's dress goods, and may be composed entirely of cotton, as in the cheapest grades, of cotton and worsted in the medium, or entirely of worsted or worsted and silk in the best grades.

The fabric considered in this article is a medium-grade cloth of ladies' dress goods, and is composed of worsted, silk and cotton and weighs 5½ ounces per yard, 36 inches wide, finished.

The pattern is a zigzag stripe, extending across the fabric in the direction of the weft on a rep ground.

Figure 1 shows the full design for the one repeat of the pattern, and is complete on 132 warp threads and 30 picks.

Figure 2 is the drawing-in draft and is complete on 13 harnesses.

Figure 3 is the reeding plan.

Figure 4 is the chain draft.

The arrangement of the warp and weft threads is as follows:

Warp, 2 threads blue 2-50s worsted (xx Ohio), 1 thread brown 2-60s cotton (carded peeler); 3 threads in pattern.

Weft, 1 pick light blue 40-2s spun silk, 2 picks brown, 20-cut cotton (wool spun); 3 picks in pattern.

20 reed, 3 threads per dent—60 threads per inch. Reeded 38½ inches wide for 36 inches finished, 40 picks per inch.

The above warp must be made on two beams: cotton threads on top beam, worsted threads on bottom beam.

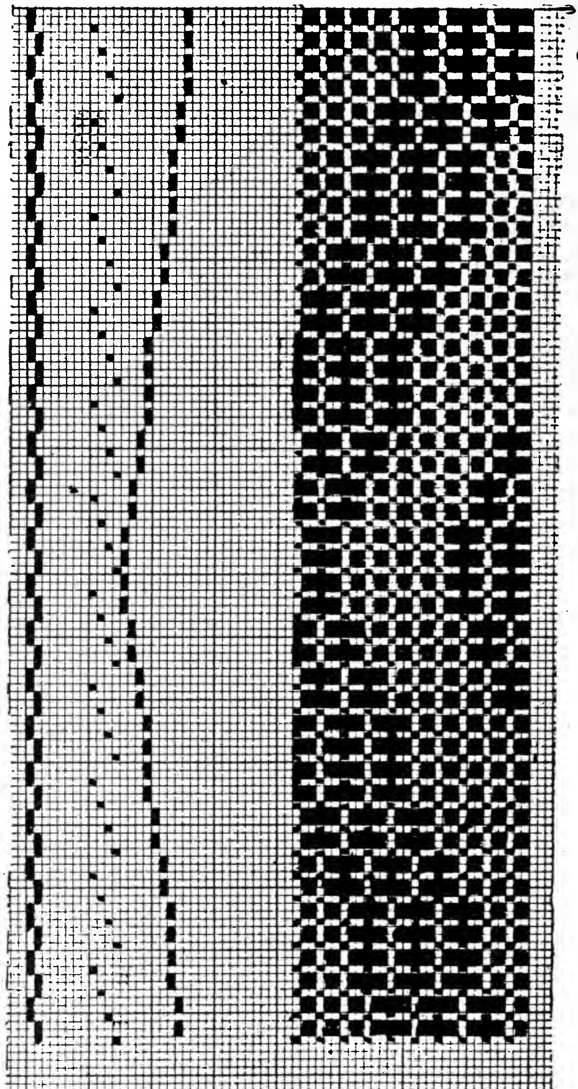
When drawing in, cotton must always come on first four shafts, and worsted on the last nine shafts.

Almost any dobby loom might be used having the required number of harnesses and shuttle boxes.

In regulating the tension of the two beams, considerable care must be used in order that the rib in the ground may be made as clear and distinct as

possible. This may be accomplished by having relatively more weight on the cotton beam than on the worsted, which is an important feature in the manufacture of all fabrics of a rep character, and which is fully illustrated by the small sketch, Figure 5. It will be noticed that the cotton (thin) threads are held very nearly straight, while the worsted are forced to bend around the heavy picks of the weft. The take-up of the worsted

Fig. 3. Fig. 2. Fig. 1



threads is therefore much greater than that of the cotton, being about eight per cent, while the cotton is only about two per cent.

The worsted warp then must be made relatively longer.

In introducing the weft threads, the

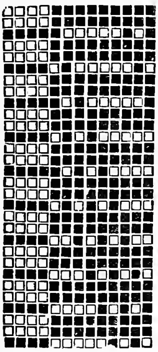


Fig. 4.

silk pick must always enter when the cotton warp threads are up in the ground portion of the cloth.

THE FINISHING.

In finishing fabrics of this character everything depends upon the quality of the cloth—the fabric just described having a dry finish; viz., after being burled and mended, it is brushed, pressed and rolled and is then ready for shipment.

In the best grades, however, the cloth must be scoured, tentered, sheared, brushed and pressed before being rolled and made ready for shipment.

Carding and Spinning Particulars.

The machines used in making the count of yarn required for the warp yarn of bayadere will be found in the second division of mills, as given in a previous lesson. Bayadere, as has been stated, may be composed of all-worsted or all-cotton yarns or a mixture of worsted and cotton yarns, or a mixture of worsted, silk and cotton. In fact, there may be almost any combination of these three fibres. The best grades of bayadere are made up of worsted and silk yarns. For this article we will consider that the fabric is composed of all three kinds of raw stock, worsted, silk and cotton. For the warp, 2-60s yarn is used and for the filling a 20-cut cotton yarn is used. The filling yarn is spun in a woolen mill and so

THE WARP YARN

will be the one considered under the above heading.

For this count of yarn a peeler cotton is used of about $1\frac{3}{8}$-inch staple. This cotton should be of a good grade and should be run through a bale breaker. The principal part of the mixing is done at the bale breaker for this cotton. The cotton is brought from the storehouse and sampled and the bales having the same length of staple are put together. Those having a staple or grade not up to mark are laid one side. Several bales are opened and placed around the bale breaker and the attendant feeds from each bale alternately until all the cotton is gone. As many bales as possible and convenient should be opened and placed around the bale breaker at one time because a

MORE EVEN MIXING

will thus be obtained and the yarn will run a great deal evener. After passing through the bale breaker the stock is conveyed automatically to the mixing bins. If the mixing is done by hand, the same points have to be looked out for, the only difference being that several hands are used instead of a machine. At the bins the good waste is mixed. The raw stock is then passed through two or three processes of picking and an opener. If only two processes of picking are used, then the particulars given for the intermediate picker may be left out, the other particulars given remaining the same. The hopper of the opener should always be kept more than half full. The speed of

THE BEATER

is 1,050 revolutions per minute. Generally a porcupine style of beater is used for this machine, with a fair speed of 350 revolutions per minute. The cotton is then passed to the breaker picker. The speed of the beater (two-bladed rigid type) is about 1,500

revolutions per minute, that of the fan, 1,400 revolutions per minute. The weight of the laps at the front should be about 40 pounds, or a 16-ounce lap. The laps are put up at the intermediate picker and doubled four into one. The speed of the beater should be 1,450 revolutions per minute. That of the fan 1,050 revolutions per minute. The weight of the laps at the front

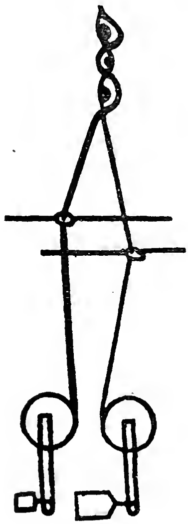


Fig. 5.

end should be about 37 pounds, or a 12-ounce lap for peeler cotton to make this class of goods.

The laps are put up at the finisher picker and doubled four into one. It is at this point that the

CUT ROVING IS MIXED IN

(it having been previously put through a special picker, which takes out the twist and leaves it in a fluffy, untwisted state and then it is put through a picker and made into a lap of the same weight as the laps from the intermediate picker), in the proportion of three laps of raw stock to one lap waste. The speed of the beater for this machine is 1,450 revolutions per minute, with a fan speed of 1,100 revolutions per minute. This gives the cotton passing through 42 beats or blows per inch. The weight of the lap at the front is 35 pounds, or a 12½-ounce lap. Watch all the points that have previously been pointed out. The variation from standard should not be over 8 ounces either side for the total lap. The lap is next taken to the card. The

SETTINGS OF THE CARD

for this division of mills have been previously given.

The draft should not exceed 100; speed of the licker-in, 300 revolutions per minute; speed of flats, 1 revolution every 45 minutes; weight of sliver, 65 grains; production about 650 pounds for week of 60 hours. Strip three times a day, grind once a month, and use as large a doffer as possible. The sliver is next put through three processes of drawing, the doublings at each process being six into one, the weight of the finisher drawing being 72 grains per yard, and the revolutions per minute of front roll 350. Either metallic or leather covered rolls may be used at this machine. If the former are used, see that they are properly set and keep them well scoured; if the latter are used, keep them in good repair, well varnished, and oiled. For this length of staple the following

SETTINGS

of the bottom steel rolls may be used: Front roll to second roll, 1½ inches; second roll to third, 1⅝ inches; third roll to back, 1¾ inches. The sliver is put through the slubber and made into .55 hank roving. Three processes of speeders or fly frames are used, the hank roving being as follows: at first intermediate 1.50; at the second 4, and at the jack frame, 12. The usual points are to be looked out for in connection with fly frames. The roving is then passed to the spinning room and made into 60s yarn. For a warp frame making this count use the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6 inches; twist per inch, 34.86; speed of spindle, 10,000 revolutions per minute. The yarn is then taken to the twister and doubled or twisted into a two-ply yarn. It is then passed to the spooler and

from here to the warper and from here to the slasher.

Dyeing Particulars.

BROWN.

5 per cent diamine brown B., 1 per cent diamine fast yellow B., 30 per cent Glauber's, 2 per cent sal soda.

LIGHT BLUE (SILK).

1 per cent patent blue, pure, 5 per cent acetic acid.

BLUE (WORSTED).

3 per cent patent blue A., 20 per cent Glauber's salt, 5 per cent sulphuric acid.

BOUCLE

Bouclé is a single cloth, dress goods fabric, weighing from 7 to 8 ounces per yard, 44 inches wide finished, and composed of plain and fancy twist (cotton) yarn in warp and filling, also having a worsted loop yarn in the filling.

Bouclé is used principally as a novelty dress fabric for ladies' spring and fall suitings, the distinguishing feature of the cloth being the small loop in the filling yarn, which curls over the face of the goods.

COTTON BOUCLE

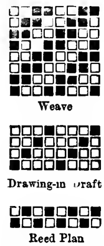
is generally made with a fancy combination weave, and the all-wool grades with a straight twill weave.

In the fabric bouclé the loop yarn is always a worsted filling thread, twisted with a single cotton thread, generally dyed black. The color effects are either solid color in warp and filling with the loop yarn in contrast, or end and end patterns, created by using fancy colored cotton twist yarns. The colors most used are: Brown, dark blue, cadet blue, light green, drab, etc., or these same colors are twisted with a black thread for twist effects. Bouclé is usually woven in the pick and pick loom, owing to the fact that there is never more than one pick of loop filling put in at one place, the arrangement generally being 4, 5, 6, 8 picks, cotton or cotton twist, to one pick of worsted loop yarn.

The woven fabric (loom) of this name is very closely imitated by a knitted fabric of similar appearance, which is a light-weight grade of astrachan.

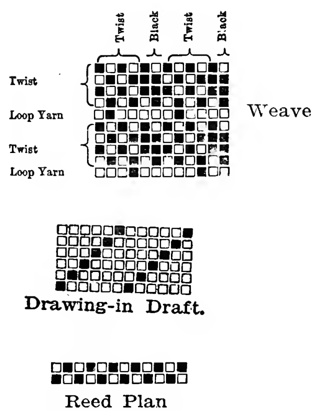
THE KNITTED FABRIC

is made of cotton yarns, wound in cone shape and placed upon the knitting



BOUCLE (Woolen)

Warp, all brown. Filling, 3 brown, 1 worsted, 1 loop.



BOUCLE (Cotton)

frame, no warp being required, and the thread which forms the loop is a regular worsted thread, dyed black and wound upon a small bottle bobbin. The loops on the face of the cloth are formed by the loop wheels in the machine throwing the worsted thread between the stitching places, upon the face of the cloth in such a manner as to form a loop.

The yarns can be taken direct from the twister and spooled upon small

6-inch spools and these spools assembled in the creel rack at the warp mill and the warp made in sections upon the mill drum, and afterward run off the drum upon the loom beam: or, the yarns are taken from the twister and the entire number of spools required are placed upon a creel rack and the whole warp made by being run around an upright mill drum, which is an upright framework centered upon an axle and turned by a crank, and having a circumference of from 20 to 50 yards.

If made upon an upright mill, the warp, when finished, is pulled off and beamed.

To finish bouclé, the goods are taken from the loom, and scoured in a solution of soap and cold water, after which they are rinsed in cold water, tentered and pressed.

CONSTRUCTION.

Reed, 720—49½ inches—1 end per dent, 20 picks per inch; 2-12s cotton warp and filling.

Warp pattern: 4 black and blue twist, 2 black.

Filling pattern: 4 black and blue twist, 1 black loop yarn.

Carding and Spinning Particulars.

The machines on which the counts of yarn are made in the manufacture of bouclé will be found in the first division of mills, as given in a previous lesson. The warp yarn is made from a cotton fibre, as is the filling yarn, but this class of cloth has an extra filling, which is spun from a worsted fibre. This worsted filling is what is known as a loop yarn and when woven into the cloth gives it a rough surface. The loops are obtained by different methods, this one being a three-ply yarn.

THE YARN

to make the filling warp yarns for bouclé is made from raw stock having a staple of about one inch. This raw stock is generally mixed, in large quantities, by hand. If two mixings are made, it is a great deal better, for then one mixing can be standing and drying out while the other mixing is being used. The good waste is mixed at this point and sometimes, although on a poor quality of goods, a small percentage of comber waste is used in the mixing. The raw stock is run through an opener and three processes of pickers. The hopper or feed box of the opener should be kept more than half full in order to obtain as even a feed as possible. The speed of the beater is 1,000 revolutions per minute.

The cotton sheet is then passed on to the feed rolls of the breaker and is struck from them by the beater, which, if of the rigid two-bladed type, makes 1,500 revolutions per minute. The total weight of the lap at the front is 40 pounds, or a 16-ounce lap. These laps are doubled, four into one, at the intermediate picker, of which the beater makes 1,450 revolutions per minute. The total weight of the lap at the front of this machine is 39 pounds, or 14½ ounces to the yard. The laps are next

DOUBLED FOUR INTO ONE

at the finisher picker. It is at this point that the cut-roving waste is mixed in the proportion of one lap cut roving to three laps raw stock. The beater of this machine makes 1,450 revolutions per minute, which gives 42 beats per inch of cotton fed. The total weight of lap at the front is 39 pounds, or a 14½-ounce lap. It will thus be seen that the doublings in a picker room, where three processes of picking are used, will be 16 against a total draft of 14.6, the individual drafts at the pickers being about 1.86 at breaker and 2.80 at the intermediate and finisher pickers. The laps are put up at the card, the draft of which for this class of goods should not exceed 100. The speed of the licker-in is 300 revolutions per minute, the top flats making one revolution every 45 minutes. The card fillet of work of this class should use No. 32 wire for cylinder and No. 33 wire for doffer and top flats (No. 32 wire equals 90s English count and No. 33 wire equals 100s). Grind wire once a month, strip three times a day, both cylinder and doffer, although some overseers strip the doffer once more. The weight of the sliver should be about 65 grains per yard and the card should produce be-

tween 900 and 950 pounds per week of 60 hours. See that your knife blades under the licker-in are properly set. The two-knife arrangement is better than the one knife. Use

A LARGE SIZE DOFFER.

In setting your doffer to the cylinder use a No. 5 gauge. Two processes of drawing are generally used and for this class of work it is the general custom to use metallic rolls, as they are better adapted to this class of work than the leather covered top rolls. In calculating the production turned off for metallic rolls always add 33 1-3 per cent over that calculated for leather covered rolls. The sliver weighs about 70 grains per yard and with 400 revolutions per minute of front roll produces 2,100 pounds per week of 60 hours. The roving is then put through the slubber and made into 40 hank roving. It is then run through

TWO PROCESSES OF FLY FRAMES,

where it is made into 1.25 hank at the first intermediate and 2.50 at the second. The roving is then taken to the spinning room. The particulars used for a warp spinning frame making 12s yarn would be as follows: Gauge of frame, 3 inches; diameter of ring, 2⅛ inches; length of traverse, 7 to 7½; speed of spindles, 19,000; and for a filling frame spinning 12s use: Gauge of spindle, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 7 inches; speed of spindle, 6,600. The yarn is then spooled, twisted into 2-ply 12s and warped, after which it is run through a slasher.

Colors for Bouclé.

Following are good formulas for dyeing bouclé:

BROWN.

10 per cent thion brown G., 10 per cent sulphide sodium, 30 per cent Glauber's, 3 per cent sal soda.

DARK BLUE.

10 per cent immedial indone B., 10 per cent sulphide sodium, 30 per cent Glauber's, 3 per cent sal soda.

CADET BLUE.

8 per cent immedial sky blue, 8 per cent sulphide sodium, 30 per cent Glauber's, 3 per cent sal soda.

LIGHT GREEN.

4 per cent immedial sky blue, 3 per cent immedial yellow D., 7 per cent sulphide sodium, 30 per cent Glauber's, 3 per cent sal soda.

DRAB.

3 per cent thion black G., ½ per cent thion brown G., 3 per cent sulphide soda, 20 per cent Glauber's, 2 per cent sal soda.

SLATE.

2 per cent immedial black NN., 2 per cent sulphide soda, 20 per cent Glauber's, 2 per cent soda ash.

BLACK.

15 per cent immedial black NB., 15 per cent sulphide soda, 30 per cent Glauber's, 3 per ecnt soda ash.

SCARLET.

6 per cent diamine scarlet B., 3 per cent sal soda, 30 per cent Glauber's.

RED.

6 per cent benzo fast red 4B., 30 per cent Glauber's, 3 per cent sal soda.

COMBED YARN GOODS—COTTON LININGS

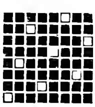
Cotton lining is a single cloth, all cotton fabric, weighing from 2 to 2½ ounces per yard, the goods finished at 20¼ inches, including ¼ inch for selvage. All combed cotton warp yarns are used in the production of this fabric, which, when finished, is used principally in the manufacture of sleeve linings and as a stiffening in the more expensive grade of ladies' and men's clothing.

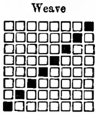
The object of treating the cotton while in the sliver state to the additional process of combing is to further assist in the operation of straightening out, or paralleling of the cotton fibres. Combed cotton, after being spun into yarn, produces a smooth, round, even thread.

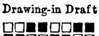
In addition, the combing process makes it possible to obtain a much better yarn than if it were not done, for not only does the combing process parallel the cotton fibres, but it removes a large portion of the short fibres which compose the roving or yarn. As is well known, the longer staples of cotton contain quite a large percentage of short fibres, and if these are eliminated, it leaves only the longer fibres and makes relatively a much stronger yarn. The reason for this is because the longer fibres have more binding places in the twisted yarn. It often happens that the use of long cotton will permit of a lower standard of twist, largely because the greater number of binding points result in more strength, than with a greater amount of twist and shorter fibres.

SLEEVE LININGS

are made of combed yarns which after being dyed the required color are glazed or polished, and this process, in connection with the weave employed, generally an eight-harness satin warp effect face, gives to the yarn in cloth the appearance of a close woven haircloth fabric. The finished fabric has a very smooth, hard, even face, though not a harsh feel.


Weave


Drawing-in Draft


Reed Plan

Linings are usually made in solid black color, or in fancy bright colored stripes, upon a black ground. The colors forming the stripe patterns are cherry red, cadet blue, yellow, red, brown, etc.

The glazing machine consists mainly of a large copper cylinder, four or five feet in diameter. This cylinder is heated to a high degree of intensity by either gas or steam.

As the cylinder revolves, there are a series of rollers working against its surface, and running in an opposite direction. These rollers are set in the machine frame above the cylinder and at regular distances, in much the same manner as the workers and stripper on a woolen card.

The yarn is fed to the machine through a pair of feed rollers, from which it passes over the face of the cylinder, and under the small rollers, or, in other words, between the cylinder and the small rollers, after which it is delivered by a pair of rollers, similar to the feed rollers. The yarn is run through the machine twice, the object being to submit all parts of its surface to the friction, to cause the glaze to come up.

The linings can be woven on any loom which contains a sufficient number of harnesses to complete the weave, though satin weaves are often employed, and this makes possible the use of cam looms, which are probably more economical for such cloth production.

Lots of trouble is thus developed by the fancy strapping required to produce the satin weave effects.

Good results are obtained by using plain, single box loom, having a dobby attached.

To finish this fabric, the goods are taken from the loom and lightly starched, then run through the calender two or three times to set the smooth, glazed finish.

There are many lining fabrics made to-day produced from grey yarns, and after being woven are bleached and dyed. These fabrics are then run through a machine which contains rolls with fine lines engraved upon them. This is often known as a milling process. It has a tendency to flatten the threads composing the cloth, and it impresses upon them many fine lines. These lines reflect the light and give a high percentage of luster. On many of these cloths an examination with an ordinary magnifying glass will show the very fine lines which are impressed upon the fabric. Probably a large percentage of lining fabrics are made from grey yarns, and piece-dyed

at present. This is the most economical method, for it eliminates a great many expensive processes.

CONSTRUCTION.

Reed, 1,000—23 inches in reed, two ends per dent; 62 picks 1-30s black cotton filling, 1-20s cotton (glazed warp) yarn.

Warp pattern: 10 black, 4 cadet blue, 10 black, 4 yellow. Weight, about 2¼ ounces; finish, 20¼ inches. Eight harness satin weave; warp effect face.

Carding and Spinning Particulars.

Cotton linings are made of various counts of yarn, according to what grade of linings is wanted. In this article we will consider that the cotton warp yarn is 1-20s combed, and the filling yarn 1-30s. The yarn for linings of this grade would be spun in mills of the second division, as given in a previous lesson, although yarns for linings are made in all three divisions of mills.

THE RAW STOCK

used should be of a fair grade, with a staple of about 1⅛ inches. This is put through a bale breaker and from here carried by a series of endless lattices to its proper bin.

The bins to hold the different grades of cotton should be plainly marked on both ends, showing the kind, grade and length of staple, so that no mistakes will occur through guesswork. If different lengths of staple get mixed together it will cause a great deal of trouble at the machines, having their rolls set at a certain distance of one length of staple.

The cotton is fed to the bale breaker in the manner described in the last lesson. The cotton is allowed to dry out as much as possible before being fed to the opener. The good waste is mixed in at the bins. This class of cotton passes through an opener and either two or three processes of picking (generally two processes being used). If only two processes are used the particulars given for the intermediate picker may be omitted. Use the different speeds of the opener and pickers as given in a previous lesson. The total weight of the lap at the front end of the breaker picker is 50 pounds, or 16 ounces to the yard. This is put up at the intermediate and

DOUBLED FOUR INTO ONE

and this lap at the front end has a total weight of 37 pounds, or 12 ounces to the yard. This lap in turn is put up at the finisher picker and doubled four into one. It is at this point that the cut-roving waste is mixed in in a proportion of three laps of raw stock to one lap of cut roving. The total weight of lap at the front is 35 pounds, or 12½ ounces to the yard. The laps are then put up at the card, the draft of which should not be less than 120. A large doffer should be used; the card should be stripped three times a day and ground at least once a month.

The cylinder speed is 160 revolutions per minute; speed of licker-in, 300 revolutions per minute. The top flats should make one complete revolution every 35 minutes. The production of the card should be 500 pounds per week of 60 hours, the weight of the sliver being 50 grains per yard. The sliver (in cans) to be used for warp yarn is collected and passed to the

SLIVER LAP MACHINE,

or, as it is sometimes called, the small doubler; here it is doubled 14 into 1 and made into a lap. This sheet of lap weighs 395 grains to the yard. Six of these laps are put up at the ribbon lap machine, or, as it is sometimes called, the large doubler. These are doubled into one sheet of lap, which weighs 260 grains per yard. Six of these laps are put up at the comber and made into a sliver weighing 45 grains per yard. The speed of the comber should be about 90 nips per minute. The machine is set so as to take out 18 per cent of waste. The draft of this machine for this class of cotton should be about 27.50.

This sliver is then put through two processes of drawing, the weight of the sliver at the front of the finisher drawing being 70 grains per yard. The speed of the front rolls of this machine is 350 revolutions per minute. Either metallic or leather covered top rolls may be used. The sliver is put through the slubber and made into .50

hank roving. This roving is passed through

TWO PROCESSES OF FLY FRAMES,

the hank roving at each being as follows: At first intermediate, 1.50; at second intermediate, 4.50. This is then taken to the ring spinning room and spun into 20s yarn, using a frame having a spindle gauge of 2¾ inches, a 2-inch diameter ring, a 7-inch length of traverse, a spindle speed of 9,400 revolutions per minute, and a twist per inch of 21.24. This yarn is next spooled, then warped, after which it is put through the slasher.

The weights and processes used for

THE FULLING YARNS

are different from the above. Starting at the card, the draft should be about 100; the flats make one complete revolution every 50 minutes; the sliver weighs 65 grains per yard, and the production is 700 pounds per week. This is then put through three processes of drawing, the weight of the sliver at the finisher drawing being 73 grains per yard. The slubber roving is .55 hank. This is put through two processes of fly frames, the hank roving being as follows: At the first intermediate 2.00 and at the second 7.25 hank. This roving is then taken to either the ring spinning or the mule room and spun into 30s yarn. If the former, use a frame having a gauge of 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 6 inches; speed of spindles, 8,300 revolutions per minute; twist per inch, 19.17.

Dyeing Particulars.

Many of the cheap linings are dyed a logwood black. By some people logwood black is asked for because the goods gain in weight, as logwood feeds the goods, adds weight and substance, and all artificial blacks reduce the weight of the cloth.

The logwood bath generally used is the steam black. First, the goods are padded in a solution of logwood about 5 degrees Tw., dried over steam cans, run through a solution of bichromate of soda four ounces to the gallon, and then run through a steam box, and afterward rinsed well in water. A one-dip aniline black is also dyed in some cases, and the oxidized aniline salt black is dyed to a large extent. The new sulphur blacks are superseding all other blacks.

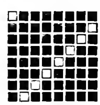
The black and colored prints are printed with resist colors, and afterward padded with aniline black, and finished with calendered beetle or schreiner finish. Most finishes are very bright and glazed.

CASHMERE TWILL

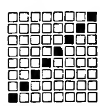
Cashmere twill is a light-weight, single cloth, weighing from 2½ to 3 ounces per yard, finished at 27 to 28 inches wide, and composed of about 1-20s cotton warp, and 1-16s to 1-20s cotton or cotton shoddy filling.

It is usually woven with an even or uneven sided twill weave, such as $\frac{2}{\ 2}$ or $\frac{7}{\ 1}$, the warp being all black, of dyed yarn, and the pattern being printed upon the face of the goods after the weaving operation.

$\frac{7}{\ 1}$



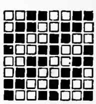
Weave



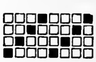
Drawing-in Draft

Reed Plan

$\frac{2}{\ 2}$



Weave



Drawing-in Draft

Reed Plan

THE PATTERNS

are generally small effects, produced by printing drabs or greys upon the black ground in imitation of twist yarn effects, the whole forming somewhat the appearance of a fancy mixed woolen fabric.

This style of cloth was used principally in the manufacture of ladies' fall novelty suitings, and can be woven on either the plain cam or a medium-weight loom having dobby attached.

To finish this fabric, the cloth is taken from the loom and run through

the printing machine to produce the pattern upon the face of the fabric, after which the goods are lightly sized and calendered.

CONSTRUCTION.

Reed, 700—30 inches in reed, 2 ends per dent—16 ends selvage $\frac{2}{2}$ 45 degrees twill weave; 1-20s cotton warp (black); 42 picks 1-16s cotton filling.

1,166 ends plus 16 equals 1,182 ends plus 5 per cent take-up in warp in weaving equals 1,227 yards 1-20s cotton warp equals 1.17 ounces; 42 picks times 30 inches equals 1,260 yards 1-16s cotton filling equals 1.5 ounces.

1.17 ounces warp weight plus 1.5 ounces filling weight equals 2.67 ounces per yard.

Carding and Spinning Particulars.

The warp yarn used in the manufacture of cashmere twills may be made in either the first or second division of mills as given in a previous lesson. The filling yarn may be made in a cotton or in a woolen mill. For this article we will consider the warp and filling yarns to be 1-20s. For this count of yarn a medium grade of cotton should be used. A bale breaker would not be used, although it would improve the yarn. The mixing would be done by hand, and as large a mixing as possible would be made at one time. By doing so there will be a saving of time and also a more even yarn will be secured. The bales of cotton should be sampled and mixed in the manner described in a previous lesson.

As the mixing is done by hand it should be allowed to stand as long as possible, so as to dry out, thus making the cotton

EASIER TO HANDLE.

It is at this point that the good waste from the machines up to the slubber is used. This waste should be pulled apart as much as possible before being thrown into the mixing, so that it will not work around the pin beater of the opener, as it is apt to do when left coiled up. The cotton is put through an opener and two processes of picking.

The speed of the beater of the opener should be about 1,700 revolutions per minute. The hopper should always be kept half full and the fly cleaned out at frequent and regular intervals. The speed of a two-bladed rigid type beater of the breaker picker for this stock should be about 1,500 revolutions per minute. The total weight at the front is 40 pounds or 16 ounces to the yard.

THE LAPS

are doubled four into one at the finisher picker, and it is at this point that the cut-roving waste laps are mixed in in the proportion of three laps of raw stock to one lap of cut waste. The speed of this beater (two-bladed rigid type) is 1,450 revolutions per minute. This will give the cotton passing through the machine about 42 beats per inch of cotton fed. The total weight of the lap at the front should be 39 pounds or 14 ounces to the yard. Take good care of your machines and keep them well oiled, cleaned and set, and the work will be greatly improved, both as to appearance and production. The lap is put up at the card and the draft should not exceed 100. The flats should make one complete revolution every 45 minutes.

THE CARDS

should be cleaned at least twice a day and the fly taken from underneath once a day. The strip waste should be gathered four times a day. The cards should be stripped (doffers and cylinders) three times a day and ground once a month, except in the case of accidents, when they should be ground until the wire is level and sharp. Light grinding should always be used. Use as large a doffer as possible, use either one having a 26 or 27 inch diameter. The production of a card on this stock should be about 800 pounds for a week of 60 hours. The card sliver is then put through

THREE PROCESSES

of drawing frames. Metallic rolls may be used to great advantage on this grade of stock. The sliver at the front of the finisher drawing frame should weigh about 70 grains to the yard. The slubber draws this sliver into .40 hank roving. It is then put through the fly frames. The

roving for warp yarns is then taken to the ring spinning room and the roving for filling may be taken to either the ring spinning or the mule room. For this class of goods the filling yarn is generally ring spun. For a warp frame spinning 20s use the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 2 inches; length of traverse, 7 inches; twist per inch, 21.24; speed of spindle, 9,400 revolutions per minute. For a filling frame use a frame having a 2¾ inches gauge, 1½ inches diameter ring, 6½ inches length of traverse, the yarn having 14.50 turns per inch, and the speed of the spindles is 7.300 revolutions per minute. The warp yarn is then spooled, warped and put through a slasher.

Dyeing Particulars.

BLACK WARP.

15 per cent sulphur black, if for jet black, immedial NN., if for blue black, immedial NB., 15 per cent sodium sulphide 30 per cent Glauber's, 3 per cent soda ash. Dyed in a warp dyeing machine. After the goods are woven and cleaned with a good soaping and rinsing, they are sent to the printer and printed with different patterns and styles, to imitate mixed woolen fabrics, and are then finished and made up like woolen goods.

BAYADERE MADE ENTIRELY OF MERCERIZED COTTON

In a previous article a description was given of a "bayadere" fabric, in which the materials of which it was constructed were cotton, worsted and silk and whose foundation was a "rep" weave.

It is now intended to show another "bayadere" fabric, but which is composed entirely of mercerized cotton and whose structure is based upon the plain weave, the finished width 36 inches and the weight 4¾ ounces per finished yard.

Such a fabric is shown in Fig. 1, which is a very good illustration of this class of patterns, whose chief feature is the zigzag stripe extending across the cloth in the direction of the weft.

The size and elaborate effect of this pattern make it resemble a jacquard effect, but it can in fact be produced on a comparatively low number of harnesses.

Fig. 2 shows the full design, which is complete on 64 warp threads and 48 picks.

As before mentioned, the plain weave is used as the

BASIS OF THE FULL DESIGN,

and between the stripes (ground) all the threads are interlaced on the plain

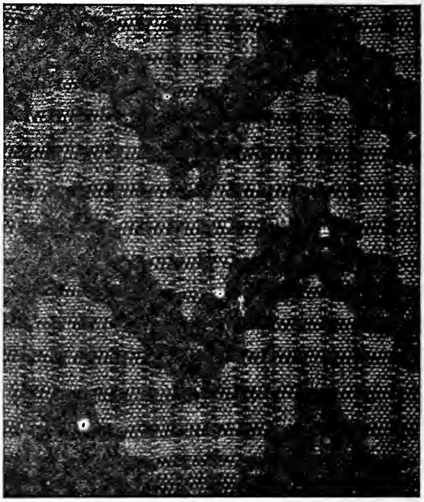


Fig. 1.

weave and form a single cloth; but the stripes themselves (figure) are formed by lowering all the fine threads (marked | at top of full design, Fig. 2) and raising all the coarse threads (marked .) to the surface of the cloth and thus forming a double cloth, with each of the two single cloths thus formed interlaced with the plain weave, throughout the stripe or bayadere.

Fig. 3 illustrates the drawing-in draft, which requires 18 shafts, 10 for

the ground and 8 for the figure threads.

Fig. 4 shows the reeding plan.

The material and arrangement of the threads are as follows:

Warp: 6 threads 2-40s blue mercerized cotton (one in a heddle), four threads 2-20s black mercerized cotton (two in a heddle); total, 10 threads in one repeat of pattern.

950 reed—38½ inches wide to finish 36 inches, 40 picks per inch.

weft the same yarn is wound double, or two threads on a bobbin, which is done for the following reason: In many cloths from which this particular pattern was derived the black cotton used was very much heavier, that is, about 2-10s or 2-12s, with one thread introduced in one heddle, instead of two threads, which made the fabric appear very coarse and open in texture; therefore, by using two threads of 2-20s the same weight of yarn is employed, but being finer, and the two

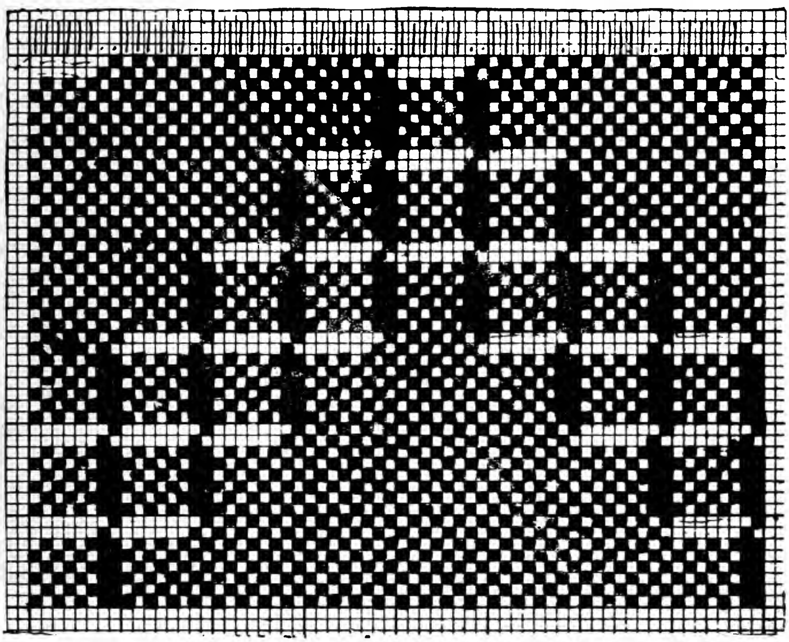


Fig. 2.

Filling: 6 picks 2-40s blue mercerized cotton (single), 2 picks 2-20s black mercerized cotton (double); total, 8 picks in one repeat of pattern.

Fig. 5 shows the chain draft required. The back picks must positively come on the bars marked.

It will be noted that the black 2-20s cotton used in the warp is introduced 2 threads in one heddle, and in the threads lying side by side, the cloth is given a much finer and closer texture.

COLORS.

In cloths of this description the bayadere stripe is generally black, which gives very great freedom in the choice of colors for the ground, as any good color may be combined with black without any danger of the other suf-

fering by being placed in juxtaposition.

THE REQUIRED LOOM.

In selecting the kind of loom for weaving the above cloth, almost any make of loom can be used which will carry 20 shafts and have the capacity of carrying at least 2 shuttles.

Dyeing Particulars.

PURPLE.

On a tannine and tartar emetic mordant, dye in fresh bath, 1 per cent methylviolet 3R.

On tannine mordanted yarn dye with ½ per cent rhodamine 5G., which dyes a pink; for a rose use 2 per cent color.

Drawing-in Draft.

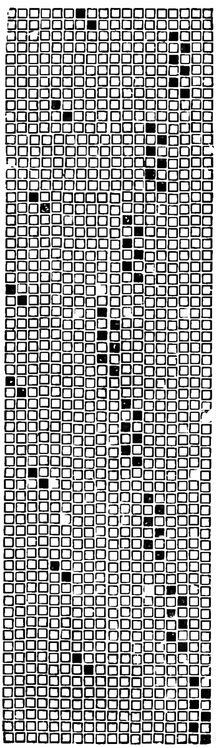


Fig. 3.

Reeding Plan.

Fig. 4.

Chain Draft.

Front.

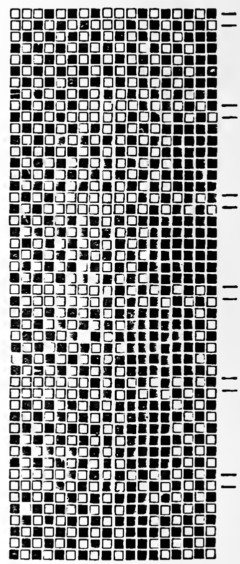


Fig. 5.

FINISH.

A dry finish only is required for this fabric and the process is as follows: After being burled and mended the cloth is brushed and steamed and then pressed so as to give as much luster as possible. After being rolled, the cloth is then ready for shipment.

SCARLET.

3 per cent diamine scarlet, 30 per cent Glauber's, 3 per cent sal soda.

CHINA BLUE.

On tannine mordanted yarn dye 1 per cent new methylene blue GG.

SKY BLUE.

3 per cent diamine sky blue, 30 per cent Glauber's, 3 per cent sal soda.

NAVY BLUE.

4 per cent diamine black BH., 30 per cent Glauber's, 3 per cent sal soda.

TURQUOISE BLUE.

On a tannine mordant dye 1½ per cent turquoise blue G.

EMERALD GREEN.

On a tannine mordant dye 2 per cent emerald green cryst.

LIGHT BROWN.

½ per cent diamine fast yellow B., 1 per cent diamine brown B, 20 per cent Glauber's, 3 per cent sal soda.

BROWN.

2 per cent tetrazo brown R., 1 per cent tetrazo brown GG., 30 per cent Glauber's, 3 per cent sal soda.

RED.

4 per cent benzo fast red 4 BS., 30 per cent Glauber's, 3 per cent sal soda.

HELIOTROPE.

2 per cent tetrazo lilac R., 30 per cent Glauber's, 3 per cent sal soda.

ORANGE.

2 per cent tetrazo orange TR., 30 per cent Glauber's, 3 per cent sal soda.

SLATE.

½ per cent diamine black BH., ½ per cent oxydiamine black A., 30 per cent Glauber's, 3 per cent sal soda.

PIQUE

Pique is a heavy cotton material woven in corded or figured effects. The goods are used for such purposes as ladies' so-called tailor-made suits, vestings, shirt fronts, cravats, bedspreads and the like.

The plainest and most common fabrics of pique are those in which the pattern consists of straight cords extending across the cloth in the direction of the weft. In the construction of these fabrics both a face and a back warp are required and the cords are produced by all the back warp threads being raised at intervals of 6, 8, etc., picks over two or more picks of the face cloth, which has a tendency to draw down on the surface of the fabric. These fabrics are generally woven and sold in a white state, but in recent years there has been a certain percentage of the goods made with colors, one color being used for the ground of the cloth and another for the ribbed or tucked portion. Some seasons this is noted more than at other times, but color is sometimes used.

Fig. 1.

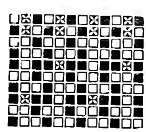


Fig. 2.

The face warp threads are generally finer than the back warp threads and are in the proportion of two threads for the face and one thread for the back.

In the diagram Fig. 1, which is a sectional cut of a fabric woven with the design Fig. 2, the heavy black lines represent the back warp threads, and it will be noticed that they are raised over two of the face picks, represented by the small dots (.).

The heavy dots (.) represent the back picks, which interlace with the back warp threads only. The fine lines represent the face warp threads.

In the heavier and better grades of pique, heavy or coarse picks, called wadding, are used to increase the weight and also to give more prominence to the cord effect. They are introduced between the face and back cloths, as illustrated by the diagram Figure 3, designated by dots o.

In the lightest and cheapest grades, neither any wadding nor back picks are used. In this case the back warp threads float on the back of the fabric, except when raising over the face picks to form the cord.

Design.

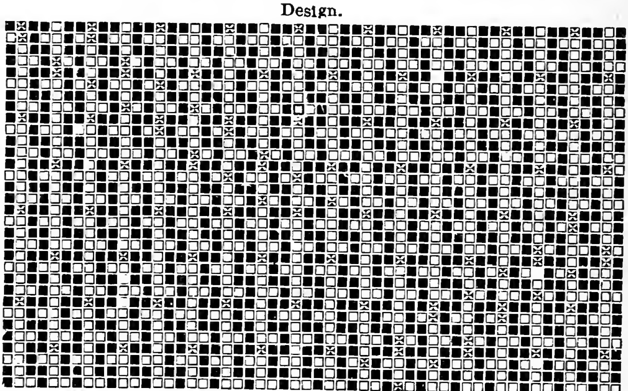
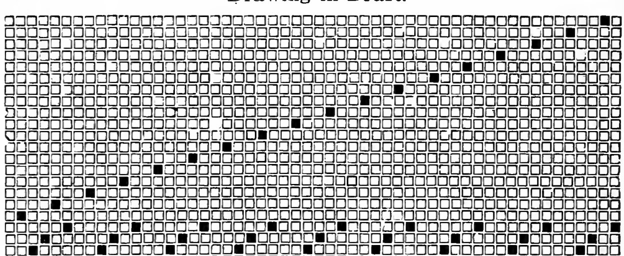


Fig. 4.

Drawing-in-Draft.



Reeding Plan.

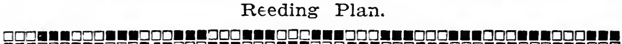


Fig. 5.

FIGURED PIQUE.

In the figured pique the binding of the back warp threads into the face cloth is not done in straight lines as in the plain pique, but the binding points are introduced so as to form figures.

These fabrics are woven in the white and the figures are purely the result of binding the face and back cloths together. As a result of this method of binding, the cloth is characterized by the embossed appearance of the figures. In the best grades heavy wadding picks are used and these tend to greatly heighten the raised effect of the figures. The effect produced is about the same as when two light cloths are laid together with wadding between and then stitched together on a sewing machine, the stitching being in the form of figures.

White Marseilles bedspreads are the highest and most elaborate form of piques, and in these the pattern covers the entire spread. Geometrical figures, birds, foliage and most every conceivable manner of form are used, and all being embossed, the ultimate effect is very fine. In the example which we shall take, a small figure

pique is given, with the following for the

ANALYSIS OF THE FABRIC:

Width of warp in reed (without selvage), 38 inches; width of fabric finished, 36 inches; ends per inch, 100; ends in warp, 3,600—1,200 x 3 reed.

Take-up of warp during weaving, 8 per cent; weight of fabric, per yard,

Chain Draft.

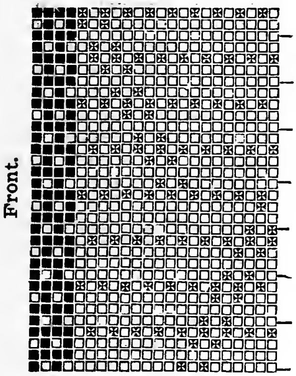


Fig. 6.

from loom, 9¾ ounces; shrinkage of fabric in length during finishing, 2 per cent; finished weight, 9 ounces.

Dressing: 3 threads in pattern. One thread, 1-30s white carded peeler cotton; 1 thread, 2-30s white carded peeler cotton; 1 thread, 1-30s white carded peeler cotton; equals 3.

Filling: 4 picks repeat of pattern, 168 picks per inch. One pick, 1-30s white carded peeler cotton; 1 pick, 1-9s white carded peeler cotton; 2 picks, 1-30s white carded peeler cotton; equals 4.

In Fig. 4 is shown the full design.

Fig. 5 illustrates the drawing-in draft on 22 harnesses—4 required for the face warp threads and 18 for the back warp threads. The reeding plan is also given.

Fig. 6 is the required chain draft.

LOOM REQUIRED.

For the plain pique a dobby loom having drop boxes and from 4 to 16 shafts only is required, but for the figured pique a loom of more intricate construction is required, and the Crompton & Knowles Loom Company build a loom especially adapted for the purpose. Their jacquard machine, which is of the rise and drop type, is especially adapted for the weaving of Marseilles quilts, and has features that dispense with the so-called "plain card," using only the figure card.

FINISHING.

These fabrics, after being scoured and bleached, are hot pressed, rolled or folded, and are then ready for shipment.

Carding and Spinning Particulars.

Pique is made up in various ways and is constructed of yarns, the count of which varies from very coarse to very fine. The fabric which is described is considered as being made up of 1-30s and 2-30s in the warp and 1-30s and 1-9s in the filling. For making this grade of cloth the machinery found in the second division of mills would be used.

THE COTTON USED

would be a good grade of "peeler," of about 1⅛-inch staple. This cotton would be brought from the storehouse and each bale sampled; all those bales not up to sample should be laid one side. The bales of the same length of staple should be opened and fed to the bale breaker alternately from each bale in small lots at a time. From the bale breaker the cotton is carried to the bins by lattice work or by trunking and a blower and fan. The mixing should be allowed to stand in the bins as long as possible before being used, so that the cotton will be free from moisture. It is at this point that the

GOOD WASTE

from the machines up to the slubber is mixed in, the sliver being torn into short lengths before being thrown into the mixing. The raw stock is put through an opener and either two or three processes of picking. If three processes of picking are used for the intermediate picker the same particulars are followed as in the case of the finisher except where noted.

The hopper of the opener should be always kept more than half full of raw

stock, so as to feed an even sheet of cotton to the breaker picker. The speed of a porcupine beater of this machine should be about 1,050 revolutions per minute. The speed of a two-bladed rigid type beater for the breaker picker should be 1,500 revolutions per minute, the fan speed being 1,400 revolutions per minute. The total weight of the lap at the front should be 40 pounds, or a 16-ounce lap. If an intermediate picker is used, the laps are doubled four into one and the

TOTAL WEIGHT OF THE LAP

at the front should be 37 pounds, or a 13-ounce lap. These laps are put up at the finisher picker and doubled four into one. At this point the cut-roving waste is mixed in, in the proportion of one lap of waste to three laps of raw stock. The speed of the beater should be about 1,450 revolutions per minute, which gives the cotton passing through the machine about 42 beats or blows per inch. The total weight of the lap at the front should be 35 pounds, or a 12½-ounce lap. Look out for your fan drafts to see that they are properly regulated so as to obtain an even lap. The laps are then put up at the card.

THE CARD

should have a draft of not more than 100. The count of wire fillet used should be medium, the wire for the tops and doffer being one number finer than for the cylinder. The card should be ground at least once a month and should be stripped three times a day. The flats should make one complete revolution every 50 minutes. Use a large doffer, either 26 or 27 inches in diameter. The weight of the sliver should be 65 grains per yard, the production for a week of 60 hours being 750 pounds. The sliver is put through three processes of drawing frames; the speed of the front roll being 350 revolutions per minute. The doublings are 6 into 1. The draft of the first intermediate is about 5.5, the second 5.75, and the third 5.75; the sliver weighing at the front of the finisher about 72 grains per yard. The sliver is then put up at the slubber and made into .50 hank roving. This roving is then put through two processes of fly frames, the hank roving at the first intermediate being 2.00, and at the second being 7.50. This makes all the roving for this cloth, except for the 9s. This is made from a 2.00 hank roving. The roving for warp yarns is taken to the spinning room and made into 30s yarn. From here it is spooled and part of it twisted into 2-30s yarn, after which it is warped and slashed. The filling yarn may either be mule or ring spun. We will consider this yarn to be ring spun. The particulars to use for No. 30s would be as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 6 inches; speed of spindle, 8,300 revolutions per minute; to spin 9s use 1⅝-inch diameter ring, 7-inch traverse, and a spindle speed of 6,200 revolutions per minute. Part of the 30s yarn is twisted into 2-30s.

Dyeing Particulars.

PEARL.

Dye in the jigger dyeing machine with 15 gallons liquor, 50 pounds weight of goods, 175 degrees F., one-half pound of soda ash, one-half pound sulphide sodium, 1 pound common salt, 3 ounces immedial black V ex., 1 ounce immedial brown B. Run the goods for 40 minutes; add in two portions the dyestuffs; rinse and aftertreat with ½ per cent bichromate potash, ½ per cent sulphate copper, at 170 degrees F., and rinse well. Give a weak soaping if required.

CREAM.

Dye with the same proportions as for pearl, and in the same way, with one-half ounce immedial yellow D., one ounce immedial cutch G.

BUFF.

Dye with same proportions as pearl, with 6 ounces immedial bronze A.

LIGHT SLATE.

Dye with same proportions as pearl, 6 ounces immedial black V.

DRAB.

As light slate; 2 ounces immedial black V; 6 ounces immedial bronze A.

LIGHT BROWN.

On the jigger, as pearl; 3 per cent immedial cutch G., 3 per cent sodium

sulphide, 3 per cent soda ash, 15 per cent common salt.

LIGHT OLIVE DRAB.

Dye as pearl; one-half pound pyrogene yellow M., 14 ounces pyrogene olive N.; 4 ounces pyrogene cutch 2G.; after-treat as pearl.

MADRAS GINGHAM

Madras gingham is distinctly a shirting fabric and is an article of fine quality. Zephyr gingham is a dress gingham and is lighter and of softer finish than the madras gingham.

Madras gingham is distinguished from the common gingham by the fineness of the texture and the richness of the patterns employed. In the common gingham the plain weave is chiefly used and the patterns consist only of stripes and checks formed by contrasting colors—principally white with some other color—and is chiefly made on cam looms.

The Fabric.

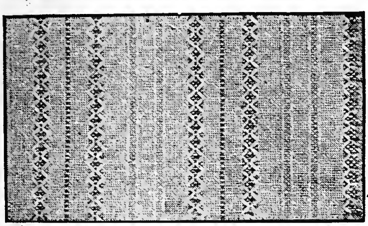


Fig. 1.

In the madras ginghams

VARIOUS WEAVES ARE USED

in combination with the plain weave which is always used for the ground, while very often leno weaves are introduced for ornamentation.

The number of colors used in conjunction with white often reaches as high as five and six in a single pattern, while printed yarns are extensively used with fine effect.

Fig. 1 is a very neat illustration of a madras gingham in a leno stripe effect. The chief features of this pattern are the leno diamond stripe on a background of old rose, and the heavy cords of white and of tan. The blue stripe between the white cords is also a prominent feature.

ANALYSIS OF THE FABRIC.

Width of warp in reed (selvage included), 29½ inches; width of fabric, finished, 28 inches; size of reed required, 1,600—ends per dent, 2 and 3; ends in warp, 2,616.

For 1-50s plain weave, 1½ per cent take-up; for 3-50s cords, no take-up, and for 3-50s leno crossing threads 50 per cent take-up.

Number of beams required, 3 (on account of the various take-ups). Weight of fabric per yard from loom, 1¾ ounces.

Shrinkage of fabric in length during finishing, 2 per cent. Finished weight, 1.92 ounces.

Pattern for beaming:

136 threads per pattern.

19 repeats of pattern in warp.

x	4	threads 1-50s white cotton.
0	1	thread 3-50s white cotton.
x	2	threads 1-50s tan cotton.
0	1	thread 3-50s white cotton.
x	10	threads 1-50s white cotton.
*	1	thread 3-50s white cotton.
x	6	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	8	threads 1-50s white cotton.
0	2	threads 1-50s fr. blue cotton as 1.
x	8	threads 1-50s white cotton.
*	1	thread 3-50s white cotton.
x	6	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	10	threads 1-50s white cotton.
0	1	thread 3-50s white cotton.
x	2	threads 1-50s tan cotton.
0	1	thread 3-50s white cotton.
x	6	threads 1-50s white cotton.
0	1	thread 3-50s white cotton.
x	2	threads 1-50s tan cotton.
0	1	thread 3-50s white cotton.
x	10	threads 1-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
x	8	threads 1-50s white cotton.
0	2	threads 1-50s fr. blue cotton as 1.
x	8	threads 1-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
*	1	thread 3-50s white cotton.
x	2	threads 1-50s fr. blue cotton.
x	10	threads 1-50s white cotton.
0	1	thread 3-50s white cotton.
x	2	threads 1-50s tan cotton.
0	1	thread 3-50s white cotton.
x	2	threads 1-50s white cotton.

Total 136 threads.

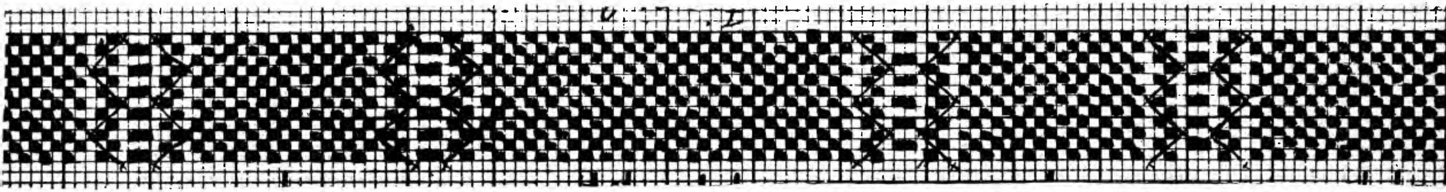
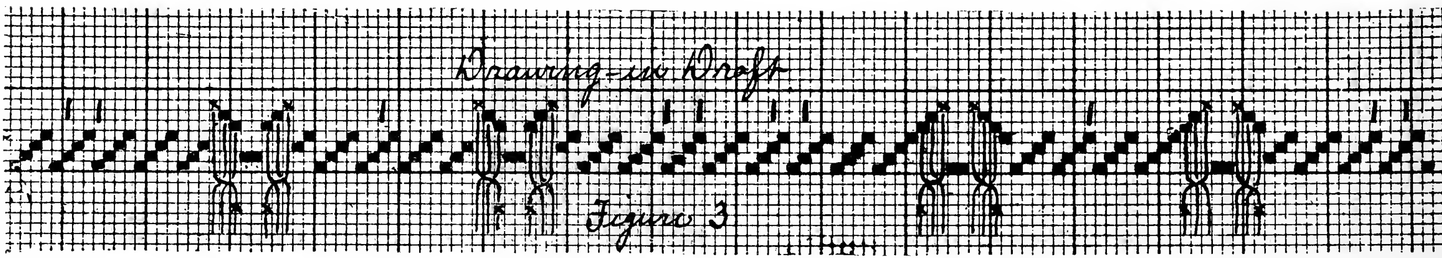


Fig. 2.



Reeding Plan.

Fig. 4.

Put threads marked x on bottom beam.

Put threads marked 0 on middle beam.

Put threads marked * on top beam.

In a good many instances the yarn is placed upon the loom beams as previously described, but there are a number of plants at least where the cords and ground yarn are placed upon the same beam. Naturally, leno yarn would have to be placed upon a top beam because of the excessive take-up. The only method which permits two-ply yarn and single yarn to be placed upon the same beam is through the correct amount of tension upon the warp beams when the loom beam is being run. A good many consider that this method is never possible, but there are many instances where it is successful and economical. There are many cases where the selvages are made of rather heavy two-ply yarn, and this yarn is run upon the loom beam together with the warp yarn which composes the body of the fabric.

1-50s cotton must be well sized.

Number of threads of each color in pattern: 1-50s white, 84; 1-50s tan, 28; 1-50s fr. blue, 8; 3-50s white, 16; total, 136.

Number of threads of each color in warp: 1-50s white, 1,628; 1-50s tan, 532; 1-50s fr. blue, 152; 3-50s white, 304; total, 2,616.

Filling: 72 picks per inch; all white 1-60s cotton.

The full design is illustrated at Fig. 2, and is complete on 136 warp threads and 12 picks. The drawing-in draft is illustrated at Fig. 3, and is complete on 7 harnesses and 2 doup shafts.

Fig. 4 is the reeding plan.

Fig. 5 is the harness chain draft for 12 bars.

THE LOOM REQUIRED.

Any ordinary dobby loom with a leno attachment can be said to be satisfactory for making most of these leno ginghams or shirting materials. A close shed loom is seldom used for such purposes, because it operates at so slow a speed, and for this reason most of the ordinary leno attachments are applied to open shed looms. A good many looms upon which fancy leno patterns are produced contain from 20 to 25 harnesses. Due to the change in demand, it is possible to sell a much wider cloth of the character described than it was some years ago.

One of the features which is seldom mentioned, but which is often of importance to manufacturers of colored yarn goods of the character described

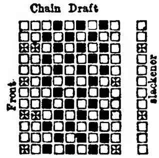


Fig. 5.

is in regard to the appearance of certain colors after the cloth is finished In such fabrics, if a dark color be used next to a light one, the various fibres of cotton will project from the dark threads and cause a very unsatisfactory appearance upon the light yarn. In some cases cloth has been rejected for this purpose alone, and mills have overcome this result by using combed yarn in place of carded yarn where black or very dark colors are being used. This same situation is noted where some of the fast colors to stand bleaching are observed. Where the colored yarn contains many fibres which project, they show up very plainly against the white threads close to them, and unless a high quality of yarn with few projecting fibres be used, some patterns will be objectionable.

FINISH REQUIRED.

After these goods are received from the looms they must be examined carefully, and all spots of dirt and grease removed, the selvages trimmed and all runners (that is, filling pulling in at the sides) and also bunches and large knots must be taken out.

They are then run through a starching machine and given a medium starching.

They are then run through a calender, which flattens out the threads and removes all wrinkles and gives the

cloth a much smoother surface, besides giving it an appearance of finer texture.

After measuring and rolling, the pieces are put in a hydraulic press and submitted to a pressure of many tons' weight. They are then labeled and papered and are ready for shipment.

Carding and Spinning Particulars.

The machinery required to make the yarns for madras ginghams will be found in mills of the second division although mills of the third division (as given in a previous lesson) also make this grade of yarn.

THE COUNT OF YARN

which we will consider in making this class of goods is 1-50s and 3-50s for the warp yarns and 1-60s for the filling. This stock is made out of a good grade of cotton, the staple of which is about 1⅜ to 1½ inches in length. The cotton is brought to the picker room and sampled and graded by the overseer in charge of the card room, although in large mills when a cotton sampler is employed he also is present at mixing time.

The bales of cotton are sampled and all those of the same length are placed together. After the lot is sampled, a few (four or five) bales are placed around the bale breaker and fed to this machine, a small lot being taken from each bale alternately until all the cotton is gone. The bagging which comes around the cotton is then placed in a pile, where later it will be picked clean of all cotton and then it is placed with other bagging, which is sold. The ties which bind the bales are also sold.

THE BALE BREAKER.

The draft of a bale breaker is quite large, but as the cotton is in large lumps it only acts on it by pulling it apart so that good deal of the draft is lost. The production of a bale breaker is from 80,000 to 90,000 pounds per week.

The cotton is conveyed by endless lattices from the bale breaker to the bins; sometimes a blower and trunks are used in connection with the lattices. Where one is used it has been found that the cotton is in better shape to work and does not have to be dried out so long in the bins. Large mixings should always be used for the reasons given in previous articles.

At the bins the sliver waste of the same length and grade of cotton is mixed into the raw stock. As this is generally done by the man that collects the waste, it is always a good plan to watch him to see that he puts the waste that he has collected in its proper bin. The raw stock for this class of goods is put through a porcupine opener and

TWO PROCESSES OF PICKING.

Keep the hopper of the opener more than half full of raw stock, because by so doing a more even feed will be obtained and this will help to make an even yarn. The speed of the beater of the opener should be about 1,050 revolutions per minute. The cotton is passed up to the feed rolls of the breaker picker. There are two of these rolls, top and bottom, and they present a sheet of cotton to the beater, which is generally of the two-bladed variety. This beater has a speed of about 1,500 revolutions per minute, and the fan a speed of 1,400 revolutions per minute. The total weight of the lap at the front end of the breaker picker is about 40 pounds, or what is called a 16-ounce lap, meaning that each yard of lap weighs 16 ounces.

The laps are taken from the breaker picker and put up at the finisher picker, the doubling (or number of laps put up) being 4 into 1. It is at this point that the cut roving, of the same length and grade, is mixed in, it having first been put through a special process which takes out the twist, and also a picker, which forms into a lap. The proportion of cut waste used is one lap of cut waste to three laps of raw stock. The beater of the finisher picker makes 1,450 revolutions per minute. The total weight of the lap at the front of the finisher picker is about 35, or a 12½-ounce lap for both warp and filling yarn. The lap is put up at the card. The draft of this machine for this

class of goods should not be less than 110; the wire fillet used on the cylinder should be No. 34 wire or No. 110 English count, and on the doffer and top flats No. 35 or No. 20 English count wire should be used. The cards should be ground once every three weeks and stripped (doffer and cylinder) three times a day. The cards should be thoroughly cleaned twice a day and wiped down twice more.

The speed of the cylinder should be 165 revolutions per minute, the licker-in speed 290 revolutions per minute. The top flats should make one revolution every 34 minutes. The weight of the sliver at the front end should be 65 grains, and the production 600 pounds per week of 60 hours. Use a larger diameter doffer, either 26 or 27 inches. On some grades of madras ginghams the filling yarn is combed, but as we have put the cotton in this article through what is called fine carding we will consider that both the warp and filling yarns are to be only carded. The sliver is taken from the card and put through three

PROCESSES OF DRAWING FRAMES.

The doublings of these machines are six into one. The weight of the sliver at the finisher drawing frame is 70 grains. Look out to see that the top rolls are all properly varnished and in good repair, or are thoroughly cleaned if metallic rolls are used; see that all stop motions are in proper working order and that the help keep the machine running. The drawing sliver is put through the slubber and made into .50 hank roving. From here it is put through three processes of fly frames and made into 10 hank for 50s count yarn and 12 hank for 60s yarn. In 10-hank roving the hanks made at the different processes are as follows: 2 at first intermediate, 4 hank at second intermediate and 10 hank at the jack frame. For 12 hank it is 2 hank at first intermediate, 4 hank at second intermediate and 12 hank at the jack frame. The roving for warp yarn is carried to

THE RING SPINNING ROOM

and spun into 50s yarn on a frame having the following particulars: 2¾ inches gauge of frame; diameter of ring, 1½ inches; length of traverse, 6 inches; speed of spindle, 10,000 revolutions per minute. This yarn is then spooled and the yarn for the plain weave is then warped and put through a slasher. The following mixing may be used for heavy counts: Water, 100 gallons; potato starch, 65 pounds; tallow, 6 pounds; Yorkshire gum, 3 pounds; white soap, 2 pounds; boil 1¾ hours. The 50s count yarn for cords and leno whip threads after being spooled is twisted into 3-ply 50s yarn on the twister machine.

The 12-hank roving for filling yarn may either be ring or mule spun. If ring spun, use a frame having the following particulars: for 60s gauge of frame, 2¾ inches; diameter of ring, 1¼ inches; length of traverse, 5 inches; speed of spindle, 8,000 revolutions per minute.

Dyeing Particulars.

YELLOW.

1 per cent tetrazo chlorine yellow GG., 30 per cent Glauber's, 3 per cent sal soda; after-treat with ½ per cent bluestone, ½ per cent chrome.

LIGHT ORANGE.

1 per cent tetrazo chlorine orange R., 30 per cent Glauber's, 2 per cent sal soda; after-treat with ½ per cent bluestone, ½ per cent chrome.

OLD ROSE.

½ per cent tetrazo chlorine rose, 25 per cent Glauber's, 2 per cent sal soda; after-treat with ½ per cent bluestone, ½ per cent chrome.

LIGHT OLIVE.

4 per cent pyrogene olive N., 4 per cent sulphide soda, 30 per cent Glauber's, 3 per cent soda ash; after-treat with 1 per cent bluestone, 1 per cent chrome.

LIGHT TAN.

4 per cent pyrogene cutch 2G., 4 per cent sulphide soda, 30 per cent Glauber's, 3 per cent soda ash; after-treat with 1 per cent bluestone, 1 per cent chrome.

SKY BLUE.

½ per cent diamine sky blue FF., 25 per cent Glauber's, 3 per cent sal

soda; after-treat with ½ per cent sulphate of copper.

LILAC.

½ per cent diamine brilliant blue G., 25 per cent Glauber's, 3 per cent sal soda; after-treat: ½ per cent sulphate of copper.

PEARL.

4 ounces diamine dark blue B., 4 ounces diamine brilliant blue G., 25 per cent Glauber's, 3 per cent sal soda; after-treat: ½ per cent sulphate of copper.

BUFF.

2 ounces diamine catechine 3 G., 2 ounces diamine catechine B., 25 per cent Glauber's, 3 per cent sal soda; after-treat: ½ per cent sulphate of copper, ½ per cent chrome.

LIGHT BROWN.

10 per cent katigen yellow brown GG., 2 per cent katigen brown V., 10 per cent sulphide sodium, 3 per cent soda ash, 30 per cent salt; after-treat 4 per cent bluestone, 4 per cent chrome, 3 per cent acetic acid.

DARK BROWN.

5 per cent diamine catechine B., 4 per cent diamine catchine G., 30 per cent salt, 3 per cent sal soda; after-treat: 3 per cent bluestone, 3 per cent chrome.

RED BROWN.

5 per cent diamine brown M., 30 per cent Glauber's, 3 per cent sal soda; after-treat: 2 per cent bluestone, 2 per cent chrome.

PINK.

½ per cent benzo fast pink, 2 BL., 20 per cent Glauber's, 2 per cent sal soda.

RED.

6 per cent primuline, 30 per cent Glauber's, 3 per cent sal soda; diazotize and develop with beta naphthol.

WINE.

As red. Diazotize and develop with Bordeaux developer.

SLATE.

2 per cent diamine jet black SS., 30 per cent Glauber's, 3 per cent sal soda, after-treat with 3 per cent chrome.

BLACK.

6 per cent diamine black B., 30 per cent Glauber's, 3 per cent sal soda; diazotize and develop with phenylene diamine.

SULPHUR BLACK.

10 per cent immedial black V., 10 per cent sulphide sodium, 30 per cent Glauber's, 3 per cent soda ash; after-treat: 3 per cent chrome, 3 per cent bluestone, 3 per cent acetic acid.

LIGHT GREEN.

On tannine and tartar emetic mordant. Dye: 1 per cent new methylene blue GG., 1 per cent thioflavine T.

BLUE.

On tannine and tartar emetic mordant. Dye: 2 per cent new methylene blue GG.

INDIGO BLUE.

10 per cent immedial indone 3 B., 10 per cent sulphide soda, 30 per cent Glauber's, 3 per cent soda ash; after-treat: 3 per cent sulphate of copper.

ETAMINE

An etamine is a thin, slightly glossy fabric used principally for women's dress goods. Being a very popular material for summer wear, it is usually made in what is commonly known as a piece-dyed fabric, that is, woven with undyed yarn. A good reason for making it a piece-dyed fabric is that it is much cheaper than if the yarn is dyed previous to the weaving. Etamines are dyed in almost any color. Blue, black, red and various shades of drabs seem to be very popular. The interlacing of the warp and weft is on the one and one order, or plain weave. See design, Fig. 1. The openness or transparency of the fabric is due partly to the smooth, hard-twisted yarn and partly to the weave.

Etamines were originally made with worsted yarns, which, of course, are much more expensive; however, if a good quality of cotton is used there is little difference in appearance between worsted and cotton etamines. The difference would be chiefly in the wearing quality, worsted, of course, being more durable.

One of the differences between a worsted and a cotton etamine is noted when the fabrics are worn. A worsted fabric does not crease very readily, and whenever it is noted the crease will soon disappear, whereas a cotton fabric, if creased, will be likely to hold the creases for quite a long time, thus making the garment somewhat objectionable.

The principal feature of an etamine is to have it a crisp, glossy and open fabric.

ANALYSIS OF FABRIC.

Width of warp in reed, 27½ inches; width of fabric finished, 26 inches. Reed, 500—2 ends per dent.

Total ends in warp 740, including selvage. Take-up of warp during weaving, 12 per cent. Weight of fabric from loom, 3 ounces per yard; weight of fabric, finished, 3 ounces per yard.

No shrinkage during the finishing process.

WARPING PLAN.

1-10s carded peeler cotton, hard twist, 20 turns per inch, a left-hand twist.

FILLING PLAN.

28 picks per inch finished; 28 picks per inch in loom; 1-10s carded peeler cotton, hard twist, 15 turns per inch, a left-hand twist.

Notice that warp and weft are both the same twist, that is, both are a left twist. This is an important factor which cannot be ignored in making an open or transparent fabric.

The warp is drawn in straight, that is, 1, 2, 3, 4 (see Fig. 2), until all the harnesses are used; four harnesses would be quite enough for a fabric of this character; there being but 26 ends per inch, would cause no overcrowding of heddles. Fig. 3 is the reeding plan. Fig. 4 shows the chain draft for a dobby loom.

LOOM REQUIRED.

This character of fabric could be woven on any cam or dobby loom, a cam loom being preferable, principally on account of the comparatively low rate of expense the latter could be operated at.

Etamines, as before mentioned, are usually woven with undyed yarns, or in the gray. The cloth, after reaching the dyehouse, is first subjected to a scouring process, then dyed, after which it is given a medium sizing, then it is calendered, which in a great measure accentuates the gloss upon the fabric and also imparts to it the crisp feeling which characterizes an etamine.

It is then measured, rolled and papered, after which it is ready for the merchant. Cotton etamine sells from 12 cents to 20 cents per yard.

Carding and Spinning Particulars.

The cloth of which the weaving particulars have been given is sometimes made of all-cotton yarn or a combination of cotton and wool or cotton and linen, or a combination of wool, silk, linen and cotton fibres. For the carding and spinning particulars of this lesson we will consider that the fabric is made up of cotton yarns in both the warp and filling.

The count of the yarn we will consider to be 10s.

THE YARNS

for this class of cloth may be made in either the first or second division

Full Design

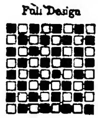


Fig. 1.

Reed Plan

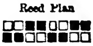


Fig. 3.

Chain Draft

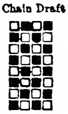


Fig. 4.

Drawing-in Draft

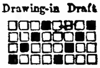


Fig. 2.

of mills, as given in a previous article. Generally, however, the mill of the second division is used. The cotton used would be American of about 1 1-16 inches length of staple. A number of bales (enough for a mixing) should be brought from the cotton shed and placed in the picker room. The overseer should sample each of the bales and those not up to staple should be placed to one side. Several of the

other bales should be placed around the bale breaker and a little fed to the breaker from each bale alternately. This will help to produce a

MORE EVEN MIXING,

which will help to give a more evenly finished yarn. The bales that have been laid aside should either be used in a cheaper mixture or should be shown to the cotton broker and either returned or have an allowance made for them. The bale breaker should be kept on this cotton until it is all put through. The cotton is conveyed from the bale breaker to the mixing bin by endless lattices, which is the old method, or by having a blower and trunking and an endless lattice as is the newer and more modern method.

When a blower is used in conjunction with the bale breaker the cotton is in a more dried out condition when it reaches the bin, and consequently it does not have to stand as long to dry out before using. A blower will pay for its first cost many times over. At the mixing bin the good waste from all machines up to the slubber is mixed in as it is collected. The cotton is next fed to the opener and

WHEN A BLOWER IS USED,

passed through two processes of picking when the cotton is mixed by hand. Three proceses of picking are generally used. A three-process picking and an opener are given, but when two processes are used all that is necessary to do is to drop the second or intermediate process and use the particulars of the breaker and finisher picker. A porcupine beater is generally used in connection with the opener, and this has a speed of about 975 revolutions per minute.

The cotton passes from the opener to the breaker picker and after passing the feed rolls it comes in contact with the beater, which is generally of a rigid two-bladed type, the speed of of which is about 1,500 revolutions per minute. The total

WEIGHT OF THE LAPS

at the front of the breaker picker is about 40 pounds or a 16-ounce lap. These laps are doubled four into one at the intermediate picker, the beater of this picker making 1,450 revolutions per minute and the total weight of the lap being 37 pounds or about a 12-ounce lap. The doublings at the finisher picker are four into one, the speed of the beater 1,450 revolutions per minute, which gives the cotton passing through it 42 beats per minute.

It is at this point that the cut roving of American stock of the same length is mixed in, in the proportion of one lap of roving waste to three laps of good cotton. The total weight of the cotton lap at the front for this class of goods is 35 pounds or a 12½-ounce lap. The next machine through which the cotton passes is

THE CARD.

This machine for this class of goods has a draft of about 90. The cards should be stripped three times a day and should be ground at least once a month. The flats make one complete revolution every 35 minutes. The production should be about 750 pounds for a week of 60 hours. The weight of the sliver at the front should be about 65 grains. Use as large a doffer as possible, either of a 26 or 27 inch diameter. The carded sliver is then put through three processes of drawing, the weight of the sliver at each process being as follows: 77 grains at breaker drawing, 76 grains at intermediate and 72 grains at finisher drawing, the doubling at each process being six into one. On this class of goods metallic top rolls may be used to good advantage. The sliver is next put through the slubber and made into .50 hank roving. The settings of the rolls at the slubber for this length of staple should be as follows: Front roll to middle, 1¼ inches; middle roll to back, 1⅝ inches. The cotton is then passed through

ONE PROCESS OF FLY FRAMES

and made into two hank roving. The roving for warp yarn is taken to the spinning room and made into 10s yarn. The following particulars are used on the warp frame: Gauge of spindle, 3 inches; diameter of ring, 2 inches; length of traverse, 7 inches; speed of spindles, 8,600 revolutions per minute.

The roving for the filling yarn may be either mule spun or, as is generally the case, ring spun.

When ring spun, use the following particulars for filling frame spinning: 10s yarn, gauge of spindle, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 7 inches (because the filling yarn for this fabric has sufficient twist put in to stand this length of traverse), speed of spindles, 6,400 revolutions per minute. The warp yarn is then spooled, warped and run through a slasher.

Dyeing Particulars.

The fabric is dyed on the jig machine.

BLACK.

15 per cent immedial black N N., 15 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's salt; rinse well, and give a soap bath.

BLUE.

5 per cent immedial indone B., 5 per cent sulphide sodium, 2 per cent soda ash, 25 per cent Glauber's salt; rinse and top with 8 ounces methylene blue B., 1 pint acetic acid.

BROWN.

6 per cent immedial brown B., 4 per cent immedial yellow D., 10 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's salt; rinse and give a soap bath.

GREEN.

4 per cent immedial yellow D., 3 per cent immedial indone B., 7 per cent sulphide sodium, 3 per cent soda ash, 30 per cent Glauber's salt; rinse and give a soap bath.

BATISTE

Batiste, as the name implies, is of French origin, commercially understood to mean a light translucent cloth, made from a fine quality of combed cotton yarn, ranging in width from 32 inches to 45 inches.

There is likewise a gradual variation in qualities, ranging from a comparatively coarse to a very fine fabric.

The variations of the different qualities will be more apparent when we consider their commercial value. It may be of interest to our readers to note the retail prices.

Cotton batiste retails at from 12½ cents in 32-inch widths to 50 cents in 45-inch width per yard.

The variety of qualities will suggest some idea of the utility of the fabric. Its uses are even more varied than are the qualities.

The finer grades of batiste are used for dress goods, all kinds of lingerie for summer wear, pillow shams, etc., while the cheaper grades are extensively used for linings in washable and unwashable shirtwaists.

In this article we are confining ourselves to bleached cotton batiste, reserving the linen and colored for some future discussion.

Batiste is woven in the gray, that is, with yarn direct from the spinning frame, with the exception that the warp yarn is well sized, in order to better stand the strain to which the yarn is subjected during the weaving process.

We will consider, first, a very fine bleached cotton batiste, of a quality made 45 inches in width, and then a very cheap grade of bleached cotton batiste, made 32 inches in width.

The analysis will readily show the vast difference in these two qualities.

FINE BLEACHED COTTON BATISTE

Width of warp in reed, 47.8 inches; finish at 45 inches; ends per inch in the cloth from loom, 94; ends per inch finished, 100; ends in warp, 4,500.

Take-up of warp during weaving, 10 per cent; weight of fabric per yard from loom, 1.15 ounces; finished weight, 1.4 ounces.

The difference in weight between fabric from loom and finished fabric is about 20 per cent, the finished goods having taken on 20 per cent of sizing material.

For adding weight to cloth, China clay is used. The proportions to use depend on the character of finish desired. China clay produces a gritty feel, which, however, may be overcome by the use of chloride of magnesium which is a very powerful softner as well as a weighting material.

Warping plan: body of warp, 1-120s combed Sea Island cotton, selvage 2-100s cotton.

Filling plan: 98 picks of 1-200s combed Sea Island cotton.

CHEAP-GRADE COTTON BATISTE.

Width of warp in reed, 34 inches. Finish at 32 inches; ends per inch in cloth in the loom, 54; ends per inch finished, 58; ends in warp, 1,860; 54x1 reed.

Take-up of warp during weaving, 8 per cent; weight of fabric per yard from loom, .84 ounce; finished weight per yard, 1 ounce; 19 per cent increase in weight.

Warping plan: all 1-60s combed Sea Island cotton.

Filling: 50 picks per inch 1-100s combed Sea Island cotton.

LOOM REQUIRED.

There is a wide divergence of opinion in regard to the use of automatic loom for fine yarn fabrics, though it is undoubtedly true that most of the important manufacturers do not consider them of any especial value. This is shown in the fact that practically none of such looms are used where the warp is finer than 70-1. In order to make an automatic loom successful it must be kept in operation and the fineness of the yarn is against such a result. Then, the weight of the heddles upon the yarn has a tendency to cause breakages much more than when such a loom is used for coarser fabrics. It is true that for fine plain cloths it is possible to operate more looms per weaver than for the coarser materials, partly because the filling lasts a much longer time. The decided loss in production on an automatic loom when fine yarns are used brings down the number of looms which can be operated and there is a much smaller difference between the number of looms per weaver on fine than for coarse fabrics. Another thing which is noted is that a light non-automatic loom can be operated at a higher speed than an automatic loom and will produce as high or a higher percentage of production so that the yards of cloth produced per weaver is not much greater with automatic looms than with the non-automatic. It must also be remembered that the price of the automatic loom is much higher than the nonautomatic and taken all together it is not probable that the automatic loom will ever be used extensively for 100-1 yarn or finer in its present condition. In fact, a good many consider its value is questionable for any fabric containing single yarn finer than 60-1. The fabric is a plain weave, no dobby being required. The fineness of the yarn, however, requires the use of string heddles. Wire heddles would cause too many warp breakages. The warp should be drawn in on four harnesses, skip draw as follows: 1, 3, 2, 4 instead of straight, as 1, 2, 3, 4. Skip draws give less strain to the warp.

FINISH.

Batistes are given a Swiss finish; after the cloth comes from the loom it is bleached. After the bleaching process it is sized, then sprinkled or dampened, and then calendered, after which it is folded; then it is ready for the market.

Carding and Spinning Particulars.

The division of mills which make "batiste" is the third of those mills which are equipped with machinery for making fine count yarns. Batiste is made up of extra fine counts of yarn, although these counts vary a great deal according to the grade of fabric wanted. In order to do this cloth justice it will be better to first describe the processes of a coarse yarn batiste and then a batiste made up of fine yarns. We will consider the coarse fabric to be made up of 1-60s warp yarn and 1-100s filling yarn. The finer grade we will consider made up of 1-120s warp yarn and 1-200s filling yarn.

THE RAW STOCK

used for both grades should be: American cotton of 1⅝ inch staple for the fabric which contains 60-1 warp and 100-1 filling and Sea Island cotton of about 1¾ inch staple for the fabric which contains 120-1 warp and 200-1 filling.

The selection of the cotton is one of the first and by many considered the

most important points to look out for. The lot should be sampled bale by bale and all those bales having a staple not up to standard should be thrown out of the mixing. Those bales that are selected as O. K. should be placed around the mixing bin and thrown into it alternately from each bale until all the bales for the mixing are in. At this point the

GOOD SLIVER AND PICKER WASTE

are mixed in. Care should be taken to see that the sliver waste is pulled apart into short lengths and that no other waste is thrown into the bins by mistake, because a small lot of short staple waste can cause a great deal of trouble later on. Some overseers use only an opener and one process of picking, others use two processes of picking with the opener. It is the general custom to use only an opener and one process of picking for these fine counts. The general instructions that have been given in regard to openers should be followed. The speed of the beater (rigid type) should be reduced so that the cotton should only receive 29 beats per minute. The weight of the lap at the front end of the picker (when one picker is used) should not exceed 30 pounds and from this range to 25 pounds.

A GOOD WEIGHT

per yard for the grade of fabric under description is 9 ounces. The machines should be carefully looked into to see that they are all kept clean and properly set. The laps are taken to the cards. At this point, as at a great many others, overseers differ as to the best means of procedure. Some use a large draft at the card and only one process of combing, and others use lower drafts and two processes of combing. In this lesson we will assume a large card draft and one process of combing for all counts of yarn in both grades of batiste. The speed of the licker should be reduced from about 350 revolutions per minute to 275 or 280 revolutions per minute. This is done by lagging the licker-in pulley. The wire fillet used on the cylinder should be No. 34 wire (American count, or 110s English count), and on the doffer and top flats No. 36 wire, or 130s English count.

THE FLATS

should be speeded up to take out as much waste as possible. The cards should be stripped three times a day and ground so as to keep the wire sharp. The settings used should be very close and care should be taken to see that the cotton is not broken in staple at the card. A great many times, if the cotton is sampled at the front of the card, it will be found to be shorter than when entering. This may be and is generally caused by an improper setting of the feed plate to the licker-in. While this applies directly to long staple cotton, still all cottons should be looked into carefully to avoid shortening the length of the staple. It is very important to keep the cards clean so that as little dust and dirt will go into the sliver as possible, because, if this dirt gets past the combers, it will show up in the cloth, as the thread or yarn is so small. The

PRODUCTION FOR A CARD

making this class of goods should not exceed 275 pounds per week, the weight of the sliver being about 30 to 35 grains per yard. The draft for this class of goods should not be less than 150. The card sliver is taken to the comber room and doubled 14 into 1 at the sliver lap, and the laps from this machine are taken to the ribbon lap machine and doubled 5 into 1. The weight of a yard of lap at the front of the ribbon lap machine should be about 160 grains. These laps are put up at the comber and doubled 6 into 1. The speed of the comber for this stock should not exceed 80 nips per minute. For this weight of web a double row of teeth in the top comb would give

THE BEST RESULTS.

Care should be taken to see that all needles in the top are straight and that the comber is absolutely free from dirt at all times. The table of the comber should be gone over twice a day with whitening so that the sliver being drawn over it will not stick. The percentage of waste taken out

should be about 25. These processes will answer for all the counts except for the 200s, which should be double combed, i. e., after being put through the combers once should be run through the sliver lap machine and then through the combers again. After passing through the combers the sliver passes through two processes of drawing. At these machines the sliver is doubled six into one, the speed of the front rolls at each frame being 320 revolutions per minute. Be sure the settings are proper for the staple so as not to "break" the staple, or too far apart so that uneven drawing will result.

THE TOP ROLLS

should be of a little larger diameter than for shorter length of staple; the grade of skin used for the top rolls should be finer than that used for the shorter and lower grades of cotton. Not only is this true in regard to the drawing frames, but also on all machines on which leather top rolls are used. Always keep these rolls in the best of shape and clean machines more often than with the lower grades of raw stock. The weight of sliver at the front is 60 grains per yard. The drawing sliver is put through the slubber, which makes it into .80 hank. This machine also uses a larger diameter top roll than is used on the lower grades. The slubber roving for 60s yarn is put through three processes of fly frames, the hank roving at the 1st intermediate being 2.25; at the second, 5 hank, and at the fine frames 12 hank. From here it is taken to the ring spinning room and made into 60s warp yarn on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1 5-16 inches; length of traverse, 5 inches.

TO MAKE 100s YARN

the slubber roving is the same, also the hank roving at the first and second intermediates. The hank roving at the fine frame is 20. This yarn for filling is taken to the mule spinning room; for warp yarn used in the finer grade of batiste is sometimes spun in the mule room and sometimes in the ring spinning room. When spun on the ring frame, use the following particulars for a warp frame: Gauge of frame, 2¾ inches; diameter of ring, 1¼ inches; length of traverse, 5 inches. For making 200s yarn the final yarn is spun single at the mule; if spun double, the frames and hank roving at each would be as follows: Slubber, .80; first intermediate, 2.25; second intermediate, 5; roving, 20, and jack 30 hank. This would be taken to the mule room and spun into 200s yarn. The warp yarn for both grades of fabric would be spooled and warped and run through a slasher.

A GOOD MIXING

for 60s yarn is as follows: Water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds; soap, 1½ pounds. A good sizing mixture for the 100s would be as follows: Water, 100 gallons; potato starch, 70 pounds; tallow, 7 pounds; Yorkshire gum, 3 pounds; soap, 2 pounds. Boil two hours and let stand 10 hours before using; keep agitator running and keep size almost at boiling point. For selvage, the 100s yarn would have to be doubled into 2-ply 100s in addition to the other processes.

Bleaching, Dyeing and Finishing.

These goods are bleached in the ordinary way, great care being taken to keep the goods from damage.

The pieces are boiled in caustic soda at 4 degrees Tw. for ten hours, rinsed well in water, and boiled again with 4 degrees Tw. caustic soda, rinsed, and scoured with ¼ degree Tw. of oil of vitriol, rinsed and passed through a solution of chloride of lime at ½ degree Tw. scoured with ½ degree Tw. oil of vitriol, and well rinsed, until all acid is washed out.

The goods are then dried, and starched through a mangle with 8-12 ounces best white German dextrine to one gallon of water, starch to be well boiled one hour before using.

The pieces are dried on a tenter frame at full width, care being taken to keep the warp and filling straight.

COLORS.

If colors are required they are light blues, pinks and other light tints dyed in the mangle or on the jig.

LIGHT PINK.

For 10 50-yard pieces, 12 gallons water; ½ ounce to 2 ounces Erika pink; 20 pounds Glauber's; 3 pounds sal soda.

LIGHT BLUE.

Dye as pink with ½ to 1 ounce tetrazo brilliant blue 6B.

LIGHT SLATE.

2 ounces diamine black BH., dye as pink.

RED.

1-2 pound benzo fast red 4B., dye as pink.

YELLOW.

Dye as pink. 8 ounces chrysophenine.

ORANGE.

Dye as pink. 1 pound Mikado orange B.

SCARLET.

Dye as pink. 1 pound diamine scarlet B.

LIGHT WINE.

Dye as pink. 1 pound diamine Bordeaux B.

LIGHT AMBER BROWN.

4 ounces diamine catechine G.; 4 ounces diamine fast yellow B., dye as pink.

TOBACCO BROWN.

½ pound diamine brown B.; 2 ounces diamine fast yellow B., dye as pink.

LIGHT TAN.

Dye as pink. 4 ounces diamine bronze G.; 2 ounces diamine fast yellow B.

LIGHT GREEN.

Dye as pink. 10 ounces diamine green G.; 5 ounces diamine fast yellow B. Top with fresh bath; 6 ounces brilliant green G.

BLACK.

Dye on jig. 15 per cent immedial black NN.; 15 per cent sulphide soda; 3 per cent soda ash; 30 per cent Glauber's salt.

ITALIAN CLOTH

Italian cloth is a light, glossy fabric made from cotton and worsted, cotton and wool, cotton and mohair and all cotton.

We will here consider the all-cotton fabric. Italian cloth is very commonly understood to mean a satin fabric, by some known as Farmer's satin.

ITS CHIEF USE.

It is used chiefly for linings for the heavier styles of ladies' dresses, also for underskirts, or for the garment itself, instead of merely as a lining; when used for such, it is usually in

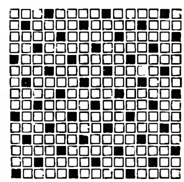


Fig. 1.

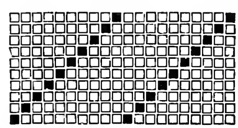


Fig. 2.

Fig. 3.

solid black. It is also used for shirtwaistings, fancy pillow backs and so forth, for these purposes usually in fancy colors.

The cloth is woven "in the gray" —undyed yarns. In the finer grades the warp is sized so as to facilitate the weaving process. The fabric under consideration is a five-harness satin weave. The satin weave, technically called "satin," is one of the three foundation weaves. The object of a satin weave is to get a smooth-face fabric.

In plain twill weaves every pick interlaces with the warp in the same manner, but each successive pick commences as if it were one end farther to the right or left, according to the di-

rection of the twill. This will bind the cloth in a regular order.

In satin weaves

THE INTERLACING

is arranged differently; the intersections of warp and weft are distributed as evenly as possible over the surface of the fabric.

The smallest and most common form of satin is the five-harness satin. The order of intersections is 1, 3, 5, 2, 4. (See Fig. 1.)

ANALYSIS OF FABRIC.

Width of warp in reed, 38 inches; width of fabric, finished, 36 inches; ends per inch in reed, 96; ends per inch, finished, 102; ends in warp, 3,700; 32 dent reed per inch—3 ends per dent. Take-up of warp during weaving is 5 per cent; weight of fabric per yard, from loom, is four ounces.

Owing to the pressure the fabric is subjected to in the finishing, it stretches slightly in length; consequently the cloth should be lighter per yard, finished, than the cloth from the loom. The difference, however, is made up by the sizing materials, although it is given but a very light sizing.

The cloth per yard finished is practically of the same weight as the cloth per yard from loom.

Warp: All 1-40s cotton, left twist.

Filling: All 1-45s cotton, left twist.

130 picks per inch.

Fig. 1 shows three repeats of the design; the weave as mentioned above is a five-harness satin, weft face, with the direction of the twill running to the right.

The fabric in question has a very smooth face, which is due in a great measure to the direction of the twill being opposite to the direction of twist of yarn.

Fig. 2 shows drawing-in draft. The warp is drawn on ten harnesses, straight draw—five harnesses would be enough; ten harnesses are used so as not to overcrowd the heddles.

Fig. 3 shows reeding plan.

The warp is reeded 3 ends in one dent.

This character of fabric could be woven on any loom where ten harnesses could be operated without difficulty. The loom should have a fairly high running speed.

FINISH.

This fabric, as before mentioned, is woven with undyed yarns. After it comes from the loom it is boiled off, bleached, then dyed, after which it is subjected to a light sizing. For a light sizing it is not necessary to use anything but wheat flour, farina and a small quantity of softening material, usually tallow or wax.

After the cloth is sized it is run through the calender with the rolls well heated, the glossy face of the fabric being obtained by the heated rolls. The cloth, after the calendering, is folded, after which it is ready for the market.

Carding and Spinning Particulars.

Italian cloth is made in mills of the second division, as given in a previous lesson. The class of cloth may be made up of several grades and lengths of raw stock, but for this article we will consider that the cotton is of a fair grade, the staple being about 1⅛ inches in length. The cotton is all sampled before being put through this bale breaker, several bales being placed around this machine, the cotton being fed alternately from each bale until all the cotton is gone. The bagging which covers these bales is thrown into a pile and is again picked over in order to clean all the fibre from the bagging. This is generally done by the yard hands on rainy days.

THE BEST METHOD

of conveying the cotton to the mixing bins is by a blower and endless lattices. When a blower is used, the cotton arrives at the mixing bins in a more open state and works up much better. At the mixing bin the good waste cotton from all the machines up to the slubber is mixed in. The cotton is fed to the hopper of the opener which should always be kept half full and from here is passed on to the feed rolls of the breaker picker. For this class of goods some overseers use

wo and some use three processes of picking. It is the general plan of up-to-date mills to use two processes with an opener. After passing the feed rolls of the breaker picker the cotton comes under the

ACTION OF THE BEATER.

If this is of a rigid, two-bladed type (which is the one most generally used) the speed should be about 1,500 revolutions per minute. The total weight of the lap at the front of the breaker picker is 40 pounds or about 16 ounces to the yard. These laps are taken and put up at the finisher picker and doubled four into one. The roving waste is mixed in at this point in the proportion of three laps of good cotton to one lap of bobbin or roving waste. The roving waste is put through a special picker that takes out the twist and delivers it in a light, fluffy state. This is taken and spread evenly on the apron of a picker and made into a lap, the weight of which corresponds to the weight of the laps of the same kind being put up at the back of the finisher picker. The speed of the beater (two-bladed rigid type) for this class of work is about 1,400 revolutions per minute. This gives the cotton passing through 42 beats per inch. The total

WEIGHT OF THE LAP

at the front of the finisher should be about 35 pounds, a variation of ½ pound being allowed from standard. If the weight is more than ½ pound, the laps should be run over again, i. e., placed at the back of the finisher and run through with three other laps. If there is a great variation in the laps, the machine should be looked into to see what is the cause. For slight variations in weight there are adjustments to quickly remedy the defects. The lap at the front for this class of goods should weigh 12½ ounces to the yard. The laps are put up at the card and the draft of this machine should not be less than 100. Medium card fillet wire should be used on both the cylinder, doffer and flats, the wire on the doffer and flats being one point finer than that used on the cylinder. The speed of the cylinder should be about 165 revolutions per minute; speed of licker-in, about 350 revolutions per minute; the speed of the top flats, 1 complete revolution every 50 minutes.

THE CARDS

should be stripped three times a day and ground surely once a month. At the time of grinding, the card wires should be all straightened out and all reset properly. Light grinding should always be used. The weight of the sliver at the front should be about 65 grains per yard. The production for a week of 60 hours (allowing 10 per cent of time for cleaning, stoppage, etc.) is about 700 pounds. The cotton sliver is then passed on to the drawing frames and through three processes of these machines. The drawing frames may be either equipped with metallic or leather covered top rolls, the speed of the front roll at each process being about 400 revolutions per minute. See that the drawing frame bottom rolls are properly set, a good setting for this stock being as follows: From center of front roll to center of second roll, 1¼ inches; second to third roll, 1⅜ inches; third to back roll, 1¾ inches.

The weight of sliver at the front of the finisher drawing frame should be 72 grains, the doubling at each process being six into one.

AT THE SLUBBER

the sliver is drawn into .50 hank roving.. From here it passes through three processes of fly frames, the hank roving being as follows: First intermediate, 1.50 hank; second intermediate, 4.00, and fine frame 10.00 hank. At the fly frame look out for the top leather covered rolls. These should always be in the best of shape. Put just enough twist into the roving so that it will not break back at the succeeding process. Remember, every extra turn of twist given the roving lessens the production. On the other hand, do not get the roving too slack twisted, for then loss of production, as well as poor work, will result in consequence of the roving breaking back. The warp roving is then taken to the spinning room and spun into 40s yarn on a frame having the following particulars:

Gauge of frame, $2\frac{3}{4}$ inches; diameter of ring, $1\frac{5}{8}$ inches; length of traverse, $6\frac{1}{2}$ inches; speed of spindle, 10,000 revolutions per minute. The roving for the filling yarn may be taken to either the ring spinning or the mule room, where it is spun into 45s yarn. If taken to the ring spinning room, use a frame of following particulars: Gauge of frame, $2\frac{3}{4}$ inches; diameter of ring, $1\frac{5}{8}$ inches; length of traverse, $5\frac{1}{2}$ inches; speed of spindles, 8,800 revolutions per minute. The warp yarn is then spooled and warped and run through a slasher.

Dyeing Particulars.

The pieces are boiled out for dark shades, and bleached white for light shades and tints.

The dyeing is done on a jig machine.

PINK.

8 ounces diamine rose GD., 20 pounds Glauber's, 1 pound sal soda. All the dyeings are for 10-12 gallons water and 10 pieces, 50 yards.

SALMON.

4 ounces diamine orange B., 1 ounce diamine scarlet B., 15 pounds Glauber's, 1 pound sal soda.

LIGHT BUFF.

4 ounces diamine catechine G., 1 ounce diamine fast yellow B., 15 pounds Glauber's, 1 pound sal soda.

LIGHT SLATE.

4 ounces diamine black BH., 15 pounds Glauber's, 1 pound sal soda.

LIGHT GRAY.

One-half pound diamine gray G., 15 pounds Glauber's, 1 pound sal soda.

LIGHT BROWN.

One-half pound diamine catechine G., ½ pound diamine brown B., 2 ounces diamine fast yellow A., 20 pounds Glauber's, 1 pound sal soda.

RED.

3 pounds diamine fast red F., 30 pounds Glauber's, 2 pounds sal soda.

SKY BLUE.

2 pounds diamine sky blue FF., 30 pounds Glauber's, 2 pounds sal soda.

SLATE.

1 pound immedial black NB., 4 ounces immedial olive B., 1 pound sulphide of sodium, 20 pounds Glauber's, ½ pound soda ash.

PEARL.

2 ounces immedial black NRT., ½ pound sulphide sodium, 10 pounds Glauber's, 6 ounces soda ash.

BLACK.

15 pounds immedial black NN., 15 pounds sulphide sodium, 30 pounds Glauber's, 3 pounds sal soda.

NAVY BLUE.

2 pounds immedial indone 3B., 2 pounds immedial indone R., 5 pounds sulphide sodium, 30 pounds Glauber's, 3 pounds sal soda.

LIGHT GREEN.

3 pounds brilliant benzo green B., 30 pounds Glauber's, 3 pounds sal soda.

HELIOTROPE.

1 pound heliotrope BB., 25 pounds Glauber's, 2 pounds sal soda.

WINE.

3 pounds tetrazo corinth G., 30 pounds Glauber's, 3 pounds sal soda.

OLD GOLD.

2 pounds diamine fast yello A., 1¼ pounds diamine brown 3 G., 30 pounds Glauber's, 3 pounds sal soda.

FINISHING.

Cotton Italians are finished with a calender finish, passed through a cotton rolled calender to get a good finish, and then softened down, with a light beetling on a beetling machine, or finished altogether on a beetling machine.

They are also given a hot press finish on the hydraulic press with hot press plates and papers, to imitate the worsted Italians.

Beetling Process for Finishing.

The beetling process for finishing cotton and linen piece goods is one of the oldest finishes in the bleaching and dyeing trades.

It was first invented in the linen bleacheries of the north of Ireland in the Belfast district. The first beetling machines were very crude affairs com-

pared with the machines now in service.

The beam on which the cloth was wound was a large tree trunk turned down and smoothed, which was set in motion with a handle. The part of the machine which lifted the fallers was also turned by hand. The principle of a finish by a beetling machine is simply an improvement on the old mangle, to smooth the cloth, and fill in the spaces between the threads, making the cloth more opaque, and showing the ordinary linen finish. A good beetle finish is also a permanent finish and will stand sponging and ironing.

THE NEW BEETLES

are made entirely of iron, except the fallers, which are wooden. The cloth is wound on the iron cylinder or beam, which revolves about 40 times a minute; the fallers are lifted by cams and fall of their own weight, about 16 inches on the cloth, from 40 to 50 times a minute. The cloth receives by this process a tremendous hammering, and where 10 or more machines are together the noise is simply deafening.

Goods made of half linen and half cotton can be finished to look like all linen goods, and in some goods made of all cotton the finish makes the pieces exactly like a piece of linen, and even

AN EXPERT MAY BE DECEIVED

thereby. Some goods are heavily starched and dryed, then sprinkled, put on the beetles, and hammered for four or five days, being sprinkled and turned occasionally. The beetles are run night and day with two crews. In Ireland, where labor is cheap and water power is used, the finish is not very expensive, although the process is very long, as the goods are often on the beetles for six days. Where steam power only is used, the finish is almost prohibitory, and as a very large and expensive plant is required to turn out a large amount of goods, not many plants of any great capacity have been erected in this country.

The largest beetling works are those of the Macnab Company, Hurlet, Paisley, Scotland. There are about 100 sections of beetles there, and some very fine work is turned out.

A GOOD FINISH

is obtained on silesias by first passing the goods through a calender and then giving a few hours on the beetle. Mather and Platt, of Manchester, have a patent beetle with spring hammers instead of fallers. This machine is said to be good for some finishes, but many prefer the old wooden faller machine. Any width of cloth can be finished on the beetle. Holland shades of over 100 inches in width are handled with ease, and the width of the cloth is always increased during the process of beetle finish.

CHEESECLOTH

This is a thin cotton fabric of light weight and low counts of yarn, which for cheapness ranks among the first in cotton fabrics.

The fact that it is a cheap fabric has much to do with its popularity, in so far that it is used for innumerable purposes; chief among which we may mention that it is used for wrapping cheeses and butter after they are pressed, for these purposes only the bleached fabric being used. It is also much in demand for bunting for festal occasions, for light curtains, masquerade dresses, etc. When used for buntings, draperies and the like, it is usually in colors. Red, blue, cream and yellow bunting seem to have the greatest demand.

In the sample which will now be considered, the cheesecloth is of a fair quality; the weave is a one and one, or plain weave; there is very little variety in the designing.

THE CHIEF OBJECT

of the designer in constructing a fabric of this character is to find the least number of ends and picks per inch required, so that the fabric will not slip too easily; that is, if the cloth is taken between the thumb and first finger of each hand, and the thumbs drawn away from each other over the surface of the fabric and first fingers, the ends, if pulling in the direction of the filling, will not leave their proper

places too easily, or, if pulling in the direction of the warp, the picks or filling will not give too easily.

This tendency to slip is entirely due to the lack of material necessary to produce a perfect or firm cloth.

A PERFECT CLOTH

may be defined as a cloth in which the warp or weft yarns are equal in diameter and the spaces between the threads are equal to the diameter of the yarn.

For instance, let us construct a perfect cloth with 1-36s cotton yarn for both warp and filling. By squaring the counts we find the diameter of yarn to be 1-165th part of an inch; that is, 165 threads of 1-36s will lie side by side in one inch, and by subtracting one-half of the 165 to allow for the space required for the interlacing with the weft we have 82 ends and 82 picks necessary for one inch of cloth.

In the sample in question there is only about half the number necessary to make perfect or firm cloth.

ANALYSIS OF FABRIC.

Width of warp in reed, 38 inches; width of fabric finished, 36 inches.

Ends per inch in reed, 42; ends per inch in finished cloth, 45.

Picks per inch in loom, 42; picks per

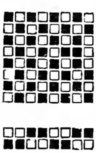


Fig 1.

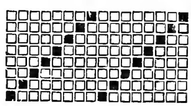


Fig 2.

inch, finished, 42; ends in warp, 1,620.

Reed, 750 x 2.

Take-up of warp during weaving 6 per cent; weight of cloth, per yard, from loom, 1.7 ounces; finished weight per yard, practically the same.

Warp, all 1-36s cotton carded peeler; filling, all 1-36s cotton carded peeler.

Fig. 1, design.

Fig. 2, drawing-in draft.

LOOM REQUIRED.

The retail price of cheesecloth, 5 to 8 cents per yard, requires that it be woven on a high running speed loom. The automatic loom would be about the best, running at about 160 picks per minute. If the warps are properly sized a weaver can take care of 16 to 32 looms.

FINISH.

Cheesecloth is given very little finish. After it comes from the loom, it passes to the dyehouse, where it is bleached or dyed as the case may be; the cloth is dyed in a gig dyeing machine. After the dyeing it is passed through a rotary press with cylinder slightly heated, after which it is folded and is then ready for the market.

Carding and Spinning Particulars.

The yarns of which cheesecloth are made up would be made in mills having an equipment of machinery for making coarse or medium grade yarns. There are several kinds and grades of cotton used for the manufacture of this cloth and the count of yarn varies, but not to such an extent as has been the case with the cloths that have been described in late articles. For this article it will be considered that the cotton is made up of a medium grade of cotton of 1 1-16 inches length of staple and that the count of the yarn for both warp and filling is 36s. The cotton is fed to the bale breaker (if the mill contains one) or the bales are placed around the mixing bin and mixed by hand.

THE HAND MIXING

does not give as uniform a mixing as the bale breaker, and when the mixing is done by hand it ought to stand longer before being used, so that it will dry out thoroughly. For this class of goods three processes of picking and an opener are used. The good waste cotton is mixed direct into the bin with the raw stock as it is collected. The cotton is then fed to the opener, which is generally supplied with a porcupine opener, and this should revolve at about 1,050 revolutions per minute. From the opener the cotton is conveyed by an endless apron to feed rolls of the breaker picker, which condense the fluffy mass into a sheet and offer

it to the beater. The beater of this machine and also of the intermediate and finisher pickers is generally of the rigid, two-bladed type. The breaker picker makes 1,500 revolutions per minute, the total weight of the lap at the front being 40 pounds, or 16 ounces per yard. These laps are put up at the intermediate picker and

DOUBLED FOUR INTO ONE.

The beater of this machine should make about 1,450 revolutions per minute, the total weight of a lap at the front being 37 pounds, or 12 ounces to the yard. The laps are put up at the finisher picker and doubled four into one, the beater making 1,450 revolutions per minute, and the total weight of the lap at the front end being 35 pounds or 12½ ounces to yard of lap. Keep the draught of the pickers on the top cage, as this will help to prevent splitting of laps; also see that the fly is not allowed to accumulate to any great extent under the machines. There should always be a supply of laps ahead, in case of a breakdown. Always use old laps first and not the newly made ones. The laps are carried to the card. The draught of this machine for this class of work should not exceed 100. The top flats should make one complete revolution every 50 minutes. Cards should be set for coarse work, using No. 33 wire on cylinder fillet, and No. 34 wire on doffer and top flats. Use a 26 or 27 inch diameter doffer.

THE SLIVER

should weigh 65 grains per yard, and the production for a week of 60 hours should be 750 pounds. The sliver is put through three processes of drawing. It would be of great advantage to use metallic rolls. The doublings at each process are six into one. The drawing sliver is put through the slubber and made into .50 hank roving. This roving passes through two processes of fly frames. At the first intermediate the hank roving is 1.56, at the second intermediate this is made into 3.75 hank, and at the fly frame 7.50. At the fly frame watch the leather top rolls. The bottom steel rolls should be taken out and scoured at least once a year. The hank roving is then taken to the ring spinning room, or the roving for the filling may be taken to the mule room and made into 36s yarn. If taken to

THE SPINNING ROOM,

use a frame having the following particulars (for 36s filling): Gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 6½ inches; speed of spindles, 10,200 revolutions per minute. For warp yarns (36s), use 2¾ inches gauge of frame; 1⅝ inches diameter of ring, and 5½ inches length of traverse, with spindles running at 8,900 revolutions per minute. The warp yarn is then spooled, warped and run through a slasher.

Dyeing Particulars.

Cheesecloth is dyed on the gig machine, or in the starch mangle during the starching process.

PINK.

For 10 gallons liquor, 3 pounds 8 ounces constarch or dextrine, 4-6 ounces Erika pink, 2 pounds Glauber's, 1 pound sal soda.

YELLOW.

As pink; 1 pound chrysophenine.

ROYAL BLUE.

As pink; 2 pounds alum, no sal soda, 1 pound Victoria blue B.

SCARLET.

As pink; 2 pounds diamine scarlet B.

RED.

As pink; 3 pounds benzo purpurine 4B.

LIGHT SLATE.

As pink; 8 ounces diamine black BH., 1 ounce diamine fast yellow B.

BROWN.

As pink; 2 pounds benzo fast orange S., 2 pounds chrysophenine, ½ pound benzo fast black.

HELIOTROPE.

As pink; 1 pound benzo fast violet R., 4 ounces benzo fast blue BN.

VELVETEEN

Velveteens, also termed fustians and velverets, are heavy cotton fabrics in which the distinguishing effect is formed by the points of the fibres in the filling yarns, termed the pile, being presented to the vision, and not the sides of the yarns as in the majority of fabrics.

They are principally used for dress and hat trimmings, suitings, and upholstery, having exceptional wearing qualities and showing a full, deep color.

Corduroys are sometimes termed velveteens, the same principle of construction being adopted in both fabrics, but a corduroy is distinguished by having a corded stripe effect running lengthways of the piece, the dividing line between each stripe showing both warp and filling.

In the simplest type of velveteens the pile filling, after being cut, hides the warp entirely from the face. To accomplish this the goods are made with a comparatively small number of ends and large number of picks per inch, ranging from 50 to 76 ends and 150 to 600 picks. One warp only is used.

A fairly heavy loom is necessary.

Figures 1 and 2 illustrate two methods of arranging the whip rolls and yarn when weaving some of the heavier picked goods. In each figure A represents the warp beam and B the whip rolls. The dotted line indicates the direction of the yarn.

Standard widths for velveteens are 19 inches, 22½ inches, 24½ inches and 27½ inches or 28 inches. For the latter width the warp is spread about 33½ inches in the loom. The weights for 28-inch goods vary from one to three and one-half yards per pound.

The goods are usually woven two or more widths in the loom, with split selvages.

In order that the fabric may remain firm after the pile picks are cut, ground or binder picks are inserted regularly, working either plain or twill as may be desired. The filling for these picks is similar to that used for the pile, only one shuttle being used.

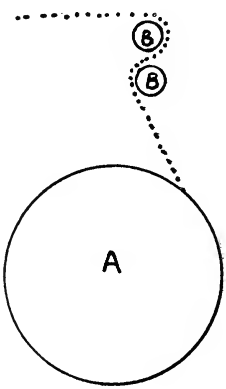


FIG. 1.

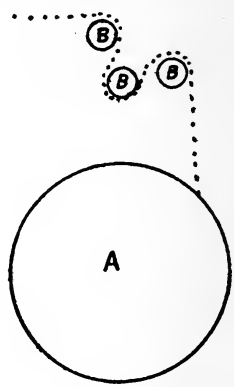


FIG. 2

Figure 3 is a design for a velveteen, arranged one ground and three pile picks, the ground weave being plain. The drawing-in draft is straight on 6 harnesses, 1 to 6. The selvages are woven with a selvage motion.

The ends are reeded 2 in each dent

The chain draft is similar to the weave, Figure 3.

Six ends and eight picks repeat.

Figure 4 shows a sectional view of the cloth before being cut. Figure 5 shows the same with the pile cut. Lettered circles in these figures correspond to ends, and numbered lines to picks, in Figure 3.

An analysis of two fabrics woven with design, Figure 3, shows the following:

Sample No. 1: 76 ends and 192 picks per inch; 28s warp and 40s filling; width 23 inches; weight 4.35 yards per pound.

This is a velveteen of poor quality.

Sample No. 2 is of a good quality. It contains 76 ends and 375 picks per inch, 2-ply 60s warp and 55s filling, and the weight is 3.35 yards per pound.

Some velveteens are sold by weight, similar to men's wear fabrics, so many ounces per yard.

Another standard fabric woven with design Figure 3 is as follows: 74 ends, 260 picks, 2-ply 70s warp, 60s filling.

of picks, therefore, the pile cannot be made very full.

PURPOSES.

For dress and trimming purposes velveteens are usually of a solid color, being piece-dyed.

For upholstery purposes the goods are dyed, printed, embossed or stamped. Panel and stripe patterns are also made by cutting a raised figure on an uncut ground, or vice versa, by painting or by the pyrogravure process, burning.

When

STAMPING

velveteens the goods are passed between two cylinders. The upper cylinder is of iron and is heated from the

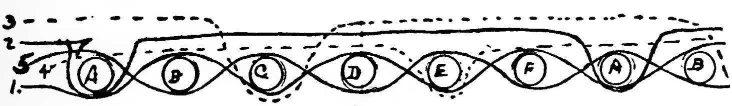


FIG.4.

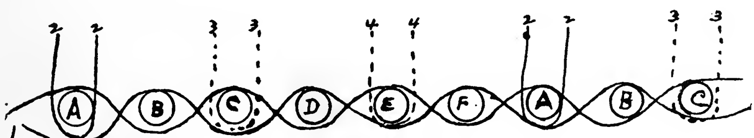


FIG.5

Figure 6 shows a design with a 3-end twill ground, arranged one ground and three pile picks. The drawing-in draft is straight, reed draft, 2 ends per dent, chain draft same as weave, repeated to 18 picks. Selvages extra.

Figure 7 shows a design for what is termed a fast back velveteen, arranged one ground and four pile picks. When each pile pick is tied under two ends, as in this example, the effect is not so good as when tied only once, but the wearing qualities are improved.

In the preceding examples it will be seen that the pile filling is bound only on every other end.

Figure 8 illustrates a design in which the pile is bound in on every end. This type makes a firm texture but does not admit of a large number

inside. The pattern is engraved or sunk into this. The lower cylinder is of hard wood. The pile is compressed by the projecting part of the upper cylinder, causing the pattern to stand out in relief from a dull ground, or vice versa.

PAINTING ON VELVETEENS

is essentially a hand process. The colors have to be free from oil that they may not spread beyond the limits intended.

In the pyrogravure process of making patterns on velveteens, the sketch is first made and placed in a pantograph machine. With a platinum stylus heated to redness the operator then burns out the pile along the lines traced, leaving a very clear pattern.

From the time a velveteen leaves the loom to the time it is ready for

cutting, it has to be passed through several processes. It is first put through a back starching and drying machine.

After drying, the better grades are raised on the under side to make a softer feeling cloth. The lower qualities are not raised on account of the tendency for the process to weaken the cloth.

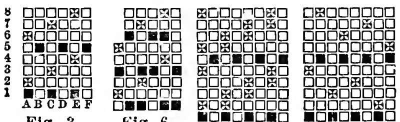


Fig. 3. Fig. 6. Fig 7. Fig. 8.

The goods are then, while under tension, saturated with a weak milk of lime, the solution being brushed into them on the face side.

The next process is drying. This is done by a device in which rods are automatically inserted below the fabric, so that the latter hangs down in loops.

After drying, the cloth is folded and passed to the brushing machine. This machine removes the lime and loosens the filling floats so that the knife can readily enter beneath them.

The cutting process proper now takes place, being done either by machinery or by hand.

Carding and Spinning Particulars.

The fabric for which the carding and spinning particulars are given below is made up in several grades. For this article only two grades will be considered, a coarse one having a warp of 1-28s and 1-40s filling; and a fine grade, the warp yarn of which is 2-70s and with a filling of 2-60s yarn. This fabric, all grades, would be made either in the second or third division of mills as given in a previous lesson. We will consider

THE COARSER GRADE

first. This would be made from a medium grade 1⅛-inch staple cotton and run through the bale breaker with blower and endless lattice connections, so that it will reach the mixing bins in a dry, open state. When feeding the bale breaker do not feed one entire lap before starting on another, but open several laps around the bale breaker and feed from each bale alternately. The mixing should be

AS LARGE AS POSSIBLE,

so that there will be less variation in the yarn than when small mixings are used. The good waste from the machines up to the slubber is mixed into the bin as it is collected. The cotton is next put through an opener and either 2 or 3 processes of pickers. It is the general custom nowadays to use 2 processes, but the particulars for three processes will be given. If one process is left out, use particulars given for breaker and finisher pickers. Feed the hopper of the opener so that it is always more than half full, because the more cotton there is in the hopper the more cotton will be taken up by the spiked apron, and thus a more even sheet will be presented to the beater, which is generally of a porcupine type and is speeded up to 1,000 revolutions per minute. The speed of the beater at the breaker picker is 1,500 revolutions per minute. The total weight of laps at the front of this machine is 40 pounds or a 16-ounce lap. These laps are

DOUBLED FOUR INTO ONE

at the intermediate. At this machine the speed of the beater is 1,450 revolutions per minute. The total weight of the lap at the front is 37 pounds or a 10-ounce lap. These laps are doubled four into one at the finisher picker, the total weight of a lap at the front being 39 pounds or 14½-ounce lap. The speed of this beater is 1,450 revolutions per minute, which gives the cotton passing through it 42 blows or beats per inch. Each lap, as it is taken from the front of the finisher picker, should be weighed, and all those laps ranging over a half a pound from the standard, either way (light or heavy), should be run over again. The

CUT-ROVING WASTE

is mixed in at the back of the finisher picker in proportion of one lap of roving waste to three laps of raw stock. The cut-roving waste has to go

through a special process to take out twist, and from here it is put through a picker which forms it into a lap, then it is mixed with the raw stock as above. From the picker the laps are taken to the card. The draft of this machine should be about 110. The settings should be medium and the wire fillet used would be No. 35 for doffer and flats and No. 34 for cylinder. The speed of the top flats should be one complete revolution every 40 minutes. The sliver at the front should weigh 65 grains per yard, and the production for a week of 60 hours should be about 800 pounds. The sliver is then put through

THREE PROCESSES OF DRAWING,

the doublings at each process being six into one.

The speed of the front roll is 400 revolutions per minute at each process. The sliver should weigh about 70 grains per yard. This is then put through the slubber and made into .50 hank roving. The roving to be used for 28s yarn is put through two processes of fly frames, the hank roving at the first intermediate being 2 and at the second 6. This is then taken to the ring spinning room and made into 28s yarn on a warp frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1¾ inches; length of traverse, 6½ inches; speed of spindles, 9,700 revolutions per minute. From here it is passed through the spooler, which takes the yarn from the cop and winds it onto a spool. From here it is wound onto a beam and several of these beams are put up at the ends and run through the slasher and wound onto a beam at the front, which has the required number of ends necessary for the warp of the fabric.

THE SLUBBER ROVING

for filling yarn is put through three processes of fly frames, the hank roving 1.50 at the first intermediate, 4 hank at the second and 8 hank at the last frame. This roving for filling may be taken to either the mule room or the ring spinning room to be made into 40s. We will consider it to be taken to the ring spinning room and spun on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 5½ inches.

FOR THE FINER GRADES

of velveteen the foregoing general particulars may be used, but substituting the following for 60s and 70s yarn: Use 1⅜ inches staple cotton; at the pickers the total weight of lap at the front is 40 pounds or 16-ounce lap at the beater and 35 pounds or 12-ounce lap at finisher, no intermediate picker being used. At the card the top flats should make one complete revolution every 40 minutes, the weight of sliver at front being 65 grains and production about 500 pounds per week.

THE DRAFT

should not be less than 120. Sometimes the filling yarn is combed, but we will consider this yarn to be carded and so it will be put through three processes of drawing. At the slubber the sliver is drawn into .55 hank roving and for both warp and filling is put through three processes of fly frames, the hank roving being as follows: To make 70s yarn: first intermediate, 1.50 hank; second, 4 hank; and jack frames, 14 hank. To make 60s yarn: first intermediate, 1.50; second, 4 hank; and fine, 12 hank. The 14-hank roving is taken and spun into 70s yarn on a

WARP SPINNING FRAME

fitted up as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; speed of spindles, 10,000 revolutions per minute; length of traverse, 5½ inches. From here it is spooled, then twisted into 2-ply and spooled again, warped and put through the slasher. The 12 roving to be made into 60s yarn may be taken either to the mule room or the ring spinning room. If taken to the ring frame, use a frame having the following: Gauge of frame, 2¾ inches; diameter of ring, 1¼ inches; length of traverse, 5 inches. The yarn is then twisted into 2-60s.

Dyeing Particulars.

Velveteen is dyed on the jigger machine in 15 gallons of liquor at 175 de-

grees F.; for 30 pounds of goods, one-half pound of soda ash, one-quarter pound sulphide sodium, 1 pound salt; boil up the liquor, add the soda, sodium sulphide and salt before adding the dyestuff, strain through a piece of calico into the jigger.

The goods are run for 30 to 60 minutes; rinse well in water after dyeing.

ECRU.

4 ounces immedial bronze A., after-treat with ½ per cent bichrome, ½ per cent sulphate copper.

LIGHT SLATE.

4 ounces immedial black V., after-treat ½ per cent bichrome, ½ per cent sulphate copper.

PEARL.

1½ ounces immedial black V., 1½ ounces immedial brown B., after-treat as slate.

FAWN DRAB.

12 ounces immedial bronze A., 2 ounces immedial brown B.

LIGHT BROWN.

1 pound immedial brown B., 4 ounces immedial cutch O., 1 pound sulphide sodium.

MEDIUM BROWN.

½ pound immedial yellow D., 1 pound immedial brown B., ½ pound immedial cutch O., 1½ pounds sulphide sodium.

DARK BROWN.

20 pounds salt, ½ pound soda ash, 5 pounds sulphide, ½ pound immedial black NRT. sodium, 8 pounds immedial brown B.

NAVY BLUE.

Dye as ecru with 2 pounds immedial blue C., 2 pounds sodium sulphide, ½ pound soda ash, 10 pounds salt; rinse and top with methylene blue N., and shade with methyl violet B.

BLACK.

2 pounds immedial black V., 2 pounds sodium sulphide, ½ pound soda ash, 10 pounds salt; rinse and top with a one-dip black, or paint with Prussian blue.

INDIGO BLUE.

For 30 pounds goods in jigger, 1 to 5 pounds pyrogene indigo, 1 to 5 pounds sodium sulphide, 1 to 2 pounds soda ash, 5 to 15 pounds salt, ½ to 1 pint mineral oil; rinse and soap, top with methylene blue.

A large number of one-dip colors are also dyed on velveteens, from light to dark shades. Although the colors are not so fast as sulphur colors, they are sufficiently fast for some trades.

After dyeing, the goods are topped with basic colors, as methyl violet with methylene blue, Bismarck brown and other bright colors.

For 30 pounds of goods, 3 pounds diamine green, 20 pounds salt, 1 pound sal soda; top with Malachite green.

SULPHUR GREEN.

2 pounds immedial indone BB., 1 pound immedial yellow D., 2 pounds sulphide soda, 1 pound soda ash, 10 pounds salt. Rinse and top with brilliant green or Malachite green.

VELVETEEN CUTTING

Velveteen cutting is one of the processes incident to making cloth that is still, to a considerable extent, done by hand for practical purposes, although machines are now in constant use for accomplishing the same results.

The object of cutting is to present to the vision the points, instead of the sides, of the fibres in the filling.

Fig. 1 illustrates the type of knife used when the cutting is done by hand. The guide A is inserted in a race of the cloth, and raises the filling to the cutting edge B. as it is forced along.

The cutting is generally done with the blade of the knife held in a vertical position, so as to cut the filling in the center of the float.

A STRIPE EFFECT

is obtained, either intentionally or unintentionally, by varying the position of the knife to the left, center or right, if two or three positions are held while cutting the same piece. Instead of cutting with the knife inclined first one way and then the other, to right and left, when making stripes with an ordinary weave, knives with two blades are sometimes used to

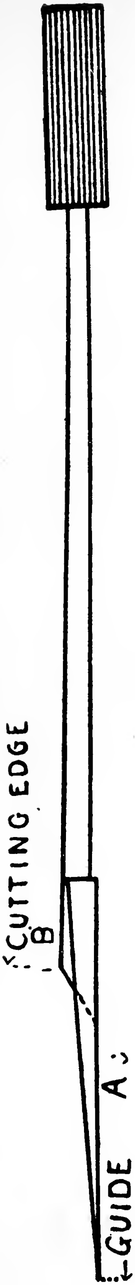


Fig. 1.

make both cuts at once, one blade being a little shorter than the other.

There are

TWO METHODS

of cutting velveteens by hand: (a) the long-frame method; (b) the short-frame method. In both these the cloth is first stretched over rollers to a suitable tension.

In long-frame cutting, two pieces are generally arranged parallel to each other about 10 or 12 yards long, with room enough for the cutter to pass between. The cutter cuts one race in one piece when walking in one direction and a race in the other piece when returning. Assuming that a 24-inch velvet with 900 races is required to be cut, the cutter will have to walk 900 x 10, which equals 9,000 yards, or over 5 miles to cut 10 yards. This illustrates how laborious the hand-cutting process is.

IN SHORT-FRAME CUTTING,

about two yards of cloth are cut before a change is made. Here the cutter, with a peculiar swing of the body, forces the knife to the end of the two yards.

Considerable skill is required in a good cutter, as a wrong movement is liable to damage the piece, either by running the knife through it or by cutting at the side instead of the center of the race.

The amount of seconds in velveteens is very large, there being many of them made after they leave the loom, as well as during the process of weaving. The least imperfection in weaving will cause trouble in cutting.

TWO KINDS OF MACHINES.

Machines for cutting velveteens are of two kinds, blade cutters, and disc or circular cutters. The blade cutters most nearly approach the results attained by hand cutting, the blades being inserted below the filling so as to force the points of the filling upward as they cut. The disc cutters cut the filling from the top of the cloth downward, the resulting pile being inferior to that cut by blades. Blade cutters

are of two kinds, single and multiple. The former have so far given the most satisfactory results on account of the difficulty of keeping the several blades in a multiple machine in perfect alignment with each other.

The blades are similar to those used when cutting by hand, except that they are smaller.

With a single blade one race is cut at a time, either in lengths of 12 yards or the entire piece, and it is necessary to repeat the operation for each race in the cloth. The blade machines proper are of two kinds, those in which the knives are stationary, the full length of cloth being passed through in an endless form, and those in which the cloth is stationary, stretched on a long table, and the knives have a horizontal movement.

Both of these types of machines are fitted with either mechanical or electrical stop motions, which cause them to stop immediately a knife jumps out or meets with an obstruction when cutting, or when the end of the race is reached.

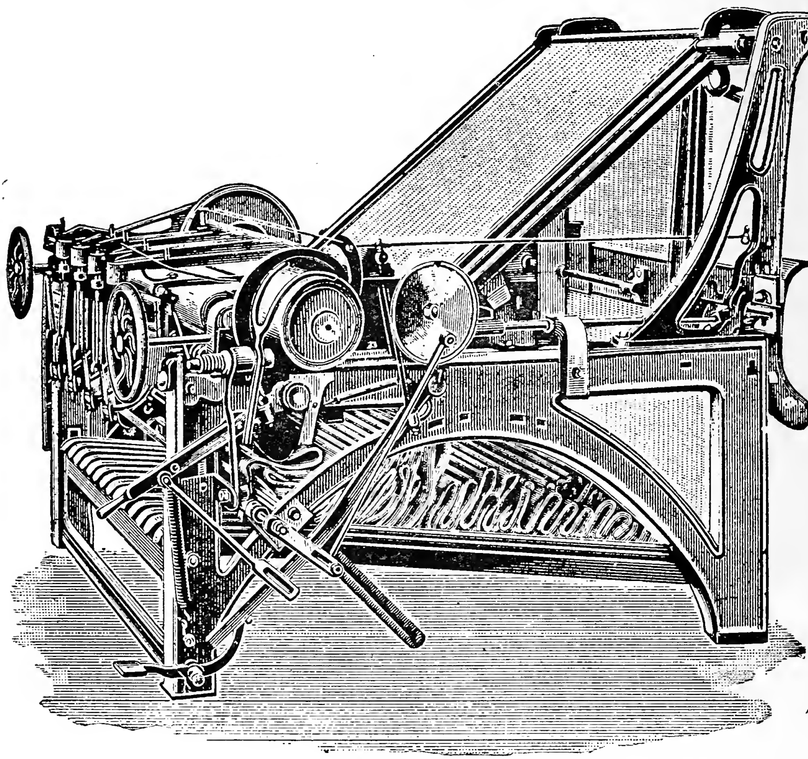


Fig. 2.

Machine cutters require the

CONSTANT ATTENTION

of a skilled mechanic to keep them in proper condition. If they are not kept sharp and exactly to gauge, the pile will appear stripey, due to uneven cutting.

Figs. 2 and 3 illustrate a continuous cutting machine with four knives.

Cloth cut by a machine of this type is claimed to be of a superior quality,

because there is no necessity to take the knives out every few yards, as is the case in hand cutting.

In addition to the regular tension devices for holding the piece tight, there are special plates arranged for holding and supporting the fabric im-

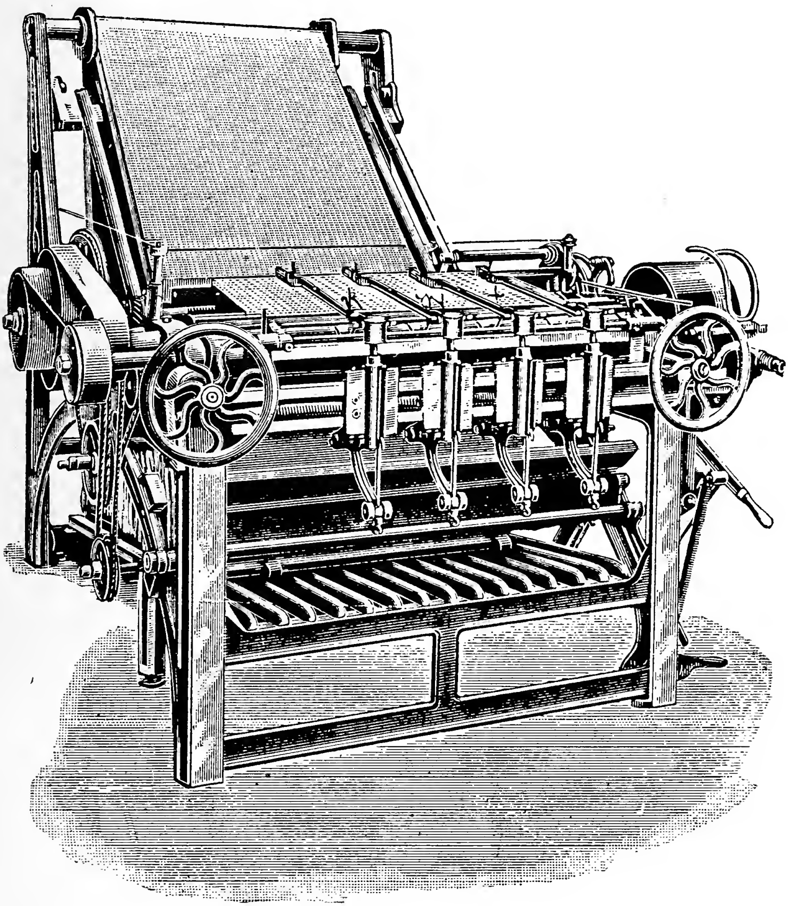


Fig. 3.

mediately under the race being cut.

The mechanism is so arranged that the knives, plates, etc., are all moved simultaneously, after each cut.

The knives are mounted on hinged arms in such a manner that they lie upon the fabric as it is fed forward, and so continuously cut it. The mounting of the knives is of such a character that in the event of an accident, the worst that can happen is the puncture of the fabric, but the hole so made is only a small one, as the knife is instantly released and the machine stopped.

When the end of a race is reached the knives are readjusted and another set of races cut.

The disc cutting machines are

fitted with cutting discs of steel plate, accurately gauged and well sharpened, mounted on a shaft, running at a speed of about 3,000 revolutions per minute. They are sharpened automatically while the machine is in motion. The number of these cutters depends on the number of races to be cut.

The discs run inside small iron triangles, which serve as guides. These guides are placed in the races of the cloth by hand, and the piece is cut as it is drawn forward by the machine. The

PRODUCTION OF A DISC CUTTER

is much greater than that of a blade cutter.

The disc machine effects quite a saving in cutting corduroys, these fabrics not having as many races as velveteens.

Devices for cutting the pile filling during the process of weaving have been tried, but have not met with success. One objection to this method is that the goods cannot be finished satisfactorily, the pile pulling out, if handled too severely.

BRILLIANTINE

Brilliantine is a dress fabric, resembling alpaca, but of superior quality and sometimes finished on both sides. Brilliantines are made with a cotton warp and luster worsted filling. Luster wool is grown in Indiana and Kentucky and is commonly known in the trade as braid wool.

Luster wools are more extensively grown in England. The best qualities are grown in Lincolnshire. The fibres of Lincolnshire luster range from 8 to 12 inches and are about 1-800th of an inch in diameter.

The wool after it comes from the sheep is sorted both for quality and luster, and the higher the degree of luster the more adaptable it is for fancy shades, while the dull or semi-luster is only used for dark colors.

Brilliantines are sometimes woven with undyed weft yarn and very rarely if ever with undyed warp yarn. They are commonly made with both warp and weft yarns dyed previous to weaving. The warp yarn may be the same color as weft or it may be entirely different. If, however, a one-colored fabric is desired and it is to be made with undyed weft yarn, the warp yarn must be dyed, previous to weaving, the same color as the weft will be dyed after the fabric is woven. The warp being cotton will not take color in a wool dye-bath.

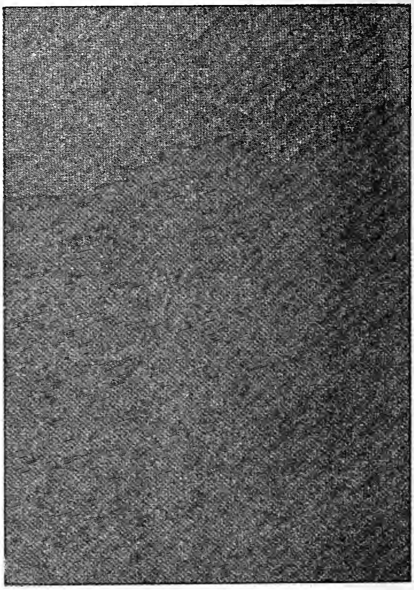


Fig. 1.

Fig. 1 shows sample in which both warp and weft are dyed previous to weaving. The warp is light brown and the weft is a medium shade of green. This contrast of colors in connection with the weave gives the fabric

A VERY PRETTY EFFECT.

Any combination of colors may be used. A very important factor to consider in making brilliantines is the weave. The object is to have as much weft floating on the face of the fabric as warp, and in figured brilliantines the figure must in all cases be a weft

floating figure. The reason for this is obvious when a lustrous fabric is desired.

The design in Fig. 2, of which two repeats are shown, both warp way and filling way, shows the filling to float

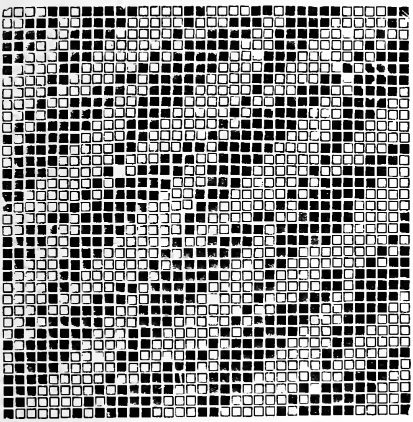


Fig. 2.

on the face of the fabric in exact proportions to the float of warp.

Very pretty effects are obtained with a plain ground weave with a small jacquard figure, and when a very lustrous fabric is wanted, the warp yarn is of finer counts than weft yarn.

ANALYSIS OF FABRIC.

Width of warp in reed (without selvage), 42½ inches; width of fabric finished, 40 inches; ends per inch in reed, 60; ends per inch finished, 64; ends in warp 2,535—light brown; 60 ends selvage white (30 ends each side), equals 2,595.

Reed 30 x 2 equals 60 ends.

Take-up of warp during weaving 6 per cent. Weight of fabric per yard from loom 5 ounces; weight of fabric finished practically the same.

Body of warp 2-40s cotton dyed; selvage 2-40s cotton undyed.

Brilliantines, mohairs and alpacas are usually made with different colored selvage yarn than the body of warp.

Filling all 1-30s luster worsted, of about ¼-blood stock.

Fig. 3 shows drawing-in draft—drawn in on 18 harnesses straight draw, pattern repeats on 18 ends and 18 picks.

LOOM REQUIRED.

For small figured brilliantine a dobby loom would be about the best. Large figures require a jacquard loom; brilliantines usually require only one kind of filling, consequently a box loom is not necessary, but in order to keep the shade of weft as even as possible when using dyed yarn, two shuttles are sometimes used weaving "pick and pick."

FINISH.

Brilliantines made with undyed weft, after they come from the loom, are first scoured, then dyed; after which they are run through a rotary press, of which the cylinder has from 50 to 60 pounds of steam heat. Brilliantines shrink a little after they come from the loom. The pressure to which they are subjected during the finishing process stretches them out to their original length. Those made with dyed yarns are usually given a dry finish, that is, they are simply run

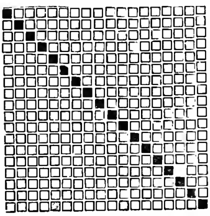


Fig. 3.

through the press, cylinder heated, after which they are rolled, then packed.

Carding and Spinning Particulars.

In a previous article, under the heading "Carding and Spinning Particulars," the mills were subdivided into three divisions. For the benefit of readers, we will repeat how they were divided for use in these articles. Mills making low count yarns say from 1s to 30s, were included in the first division, those making medium

count yarns, or from 30 to 70s, were included in the second, and the third division comprised mills making yarns from 70s up. This does not mean that only the yarns between the counts given are made in one division, but that the greater portion of the counts of yarn made in the divisions referred to are between the counts given. The

COUNT OF COTTON YARN

used for brilliantine for this article is 2-40s. The filling yarn is luster worsted yarn, and therefore we will only deal with the cotton warp yarn. This class of yarns is made in the second division of mills, the cotton used being of a medium grade and having a staple of about 1 3-16 inches. The equipment for the second division of mills may call for a bale breaker or not. We will consider that one is included. The bales of cotton are stapled and several placed around and fed to the bale breaker alternately from each bale until all are gone. The bale breaker has a capacity of about 80,000 pounds per week of 60 hours. The cotton is carried by endless moving aprons so arranged that they may be moved so as to allow the cotton to be dropped into its proper bin. The bins should be as large as possible so as to allow

A LARGE MIXING.

At this point the sliver waste from the machines up to the slubber is mixed with the raw stock. The cut-roving waste of the same length and grade of staple is not mixed at this place, but has to go through a special picking machine, which takes out the twist, then it is put through a picker and made into a lap, after which it is mixed with the raw stock, as will be shown later. The equipment for this division may include two or three processes of pickers. We will consider that it contains an opener and three processes of picking.

THE BEATER

used is generally of the porcupine pattern and the speed should be about 1,000 revolutions per minute for this class of work. The opener is generally attached to the breaker picker and after passing the beater of the opener the cotton is passed to the feed rolls by a moving endless apron. At this point the cotton is in an open, fluffy state. The feed rolls condense the cotton, as it passes between the rolls, into a sheet, and in this state it is presented to the beater of the breaker picker. This beater is generally of a rigid, two-bladed type, and for the cotton in question has a speed of 1,500 revolutions per minute. The cotton is then blown onto a set of cages and compressed into a sheet, after which it passes through several sets of calender rolls between which it is further pressed. The total weight of the lap at the front is 40 pounds or about 16 ounces to the yard. These laps are put up at the back of the intermediate picker and

DOUBLED FOUR INTO ONE.

The speed of this beater is about 1,450 revolutions per minute. The total weight of the lap at the front is 37 pounds or a 10-ounce lap. These laps are put up at the finisher picker and doubled four into one. It is at this point that the cut-roving waste before spoken of is mixed in the proportion of three laps of raw stock to one lap of roving or bobbin waste. The speed of this beater is about 1,450 revolutions per minute, which gives the cotton passing it about 42 beats or blows per minute. The total weight of the lap at the front of this picker is 39 pounds or about a 14-ounce lap. These laps are then taken to the card, the draft of which for this class of work should not exceed 110. The fillet on the cylinder should be of No. 34 American wire or 110s English count and on the doffer and top flats should be No. 35 wire or 120s English count. The top flats should make one complete revolution every 45 minutes.

THE CARDS

should be stripped (both cylinder and doffer) three times a day and ground at least once a month. The cards should be reset after every grinding in all parts, except the top flats to the cylinder, which should be reset at least four times a year. The weight of sliver at the delivery end of the card should be about 65 grains per yard. The cotton is next put through

three processes of drawing frames. Metallic rolls may be used to good advantage on work of this description, the speed of the front roll at each process being 400 revolutions per minute. The weight of the sliver at the finisher drawing frame should be about 70 grains. The cotton is next put through the slubber and made into .55 hank roving.

The roving is then put through

THREE PROCESSES

of fly frames. At the first intermediate it is made into 1.50 hank roving, at the second intermediate into 3 hank and at the jack frame into 9. This roving is then taken to the ring spinning room and spun into 40s yarn on a frame with the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 6½ inches; twist per inch, 28.-46; revolutions per minute of spindles, 10,000. From here it is passed to the spooler and then to the twister, where it is twisted into 2-40s, and then back to the spooler. From here it goes to the warper and from the warper the beams are put up at the slasher, where it is sized, and then it is ready for the weave room.

Dyeing Particulars.

These goods are dyed in the piece if solid shades are wanted, but if two-colored fancies are made, the warp and the worsted yarn are dyed in the yarn, woven and finished. For piece dyes union colors are used, or the wool is dyed in an acid bath, rinsed and the pieces are cotton dyed cold.

For union black, 5 per cent union black A., 30 per cent Glauber's salt. Boil until wool is dyed, and run without steam until cotton is dyed up to shade; if cotton is not dark enough add some cotton black.

The union fancy colors are dyed in the same way.

Wool yarn dyeing. For 100 pounds yarn, 10 pounds Glauber's salt, 3 pounds sulphuric acid. Enter pieces at 150 degrees, bring to boil and boil 40 minutes.

LIGHT SAGE GREEN.

1¼ ounces orange II.; 1¼ ounces cyanole BB.; ¼ ounce fast yellow S.

MEDIUM SAGE GREEN.

6 ounces orange II.; 2 ounces fast yellow S.; 1 pound cyanole BB.

DARK SAGE GREEN.

10 ounces orange II.; 3 ounces fast yellow S.; 1¼ pounds cyanole BB.

MEDIUM OLIVE GREEN.

1½ pounds fast yellow S.; 6 ounces orange II.; 1 pound cyanole BB.

OLIVE GREEN.

2½ pounds fast yellow S.; ½ pound orange II.; 1½ pounds cyanole BB.

BOTTLE GREEN.

3 pounds fast green bluish; ½ pound fast yellow S.; ½ pound formyl violet S. 4B.

NAVY BLUE.

2 pounds indigo blue SGN.; 2 ounces formyl violet S. 4B.

DARK NAVY BLUE.

4 pounds indigo blue SGN.; ½ pound orange II.; ½ pound formyl violet S. 4B.

SLATE.

6 ounces alizarine blue SAP.; ½ ounce orange II.; ½ ounce fast yellow G.

RED.

4 pounds fast red NS.; 6 ounces orange II.

ROSE.

3 pounds rhodamine B.; 1 pound rhodamine 5G.

SCARLET.

3 pounds brilliant scarlet 1R.

BROWN.

2½ pounds orange II.; ½ pound fast green bluish; 3 ounces fast acid violet 10B.; ½ pound fast yellow G.

The warps are dyed in the chain dyeing machine with fast sulphur colors if possible. For 100 pounds warp:

BLUE.

8 pounds immedial indone 3B.; 16 pounds sodium sulphide; 8 pounds glucose; 3 pounds soda ash; 15 pounds Glauber's.

SLATE.

3 pounds thion black G.; 3 pounds sodium sulphide; 2 pounds soda ash; 20 pounds Glauber's.

FAWN DRAB.

6 pounds immedial cutch O.; 6 pounds sodium sulphide; 2 pounds soda ash; 20 pounds Glauber's.

GREEN.

4 pounds immedial yellow D.; 4 pounds immedial indone 3B.; 8 pounds sodium sulphide; 2 pounds soda ash; 30 pounds Glauber's salt.

OLIVE.

7 pounds immedial olive 3G.; 2 pounds immedial dark green B.; 10 pounds sodium sulphide; 30 pounds Glauber's salt; 3 pounds soda ash.

NAVY BLUE.

10 pounds immedial dark blue B.; 10 pounds sodium sulphide; 30 pounds Glauber's salt; 3 pounds soda ash.

The fancy shades can also be dyed with one-dip salt colors and tannine basic colors.

CALICO

A calico may be defined as a cotton cloth with a figured design printed on one side; generally speaking, any printed cloth coarser than muslin, used principally for inexpensive dresses, such as shirtwaists, wrappers, and so on.

The majority of inexpensive cotton fabrics are constructed on the one-up, one-down system, or plain weave. Calico is no exception to the rule. Its ornamentation, however, is given it after the cloth comes from the loom. As mentioned above, calico is a printed cloth,

THE PRINTING

being effected by means of a printing machine, which may be described as an elaborate machine with a rotating impression cylinder, on which the design has been stamped, or cut. The cloth, in passing through the machine, comes in contact with the impression cylinder. The cylinder, revolving in a color trough, takes up the color and leaves the impression of the design on the cloth. Calicoes may be seen in almost any color. The printing machine is capable of printing several

COLORS

in one design. Calicoes, however, are usually in but two colors, that is, one color for ground and one for the figure.

The method of placing the color upon the fabric depends a good deal upon the kind of a pattern which is to be made, and the results desired. In some instances the figure is printed upon the cloth in a kind of resist, and then the fabric is taken and piece dyed. Wherever the resist figures are

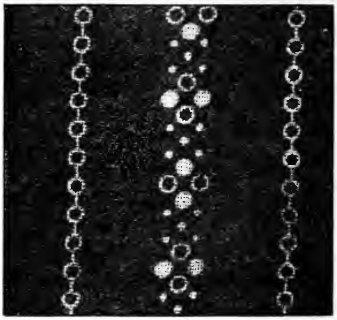


Fig. 1.

printed the color does not take and the figures show on a solid colored ground. Whenever the ground of the fabric is largely white the figures are printed in various colors as desired. There are a few instances where the fabric is dyed first and then a printed pattern applied afterward, though this is not so common a practice as the ones previously mentioned. The development of so many new colors and the variation in the method of applying them has made many new processes possible in printed fabrics, and it often happens that results are secured through more than one method.

The printed designs on calicoes may be somewhat elaborate or they may be some simple geometrical figures. In order, however, to comply with the true principles of art, such fabrics as calicoes should have but simple geo-

metrical figures for their ornamental features.

Fig. 1 shows a sample of calico, with a printed geometrical figure, the simplicity of which is in harmony with the structure of the fabric.

We may here mention that with all machine repeating designs the figures must be laid out in conformity with the dimensions of the printing roll. For instance, say, the printing roll measures six inches in circumference, and the design which we wish to print is but two inches in its vertical repeat, in order to have perfect repetition we must have three repeats of the design stamped on the impression roll.

The circumference of the printing roll will, therefore, control the size and proportion of the design. The design must be so adjusted that the repeat will occur with the utmost accuracy.

Calicoes are made in comparatively narrow widths. The one under discussion is but 23½ inches, finished.

ANALYSIS OF FABRIC.

Width of warp in reed, 25½ inches; width of fabric finished, 24 inches;

Design.

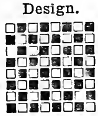


Fig. 2.

Drawing-in-draft

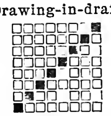


Fig. 3.

ends in finished cloth per inch, 72; ends in warp, 1,700; ends per inch in reed, 66 2-3; 1,200 x 2 reed.

Take-up of warp during weaving, 7 per cent; weight of fabric, per yard, from loom, 2 ounces; weight of fabric finished, 2 ounces; warp all 1-30s carded peeler.

Filling: 52 picks per inch in loom; 52 picks per inch finished.

Count 1-30s carded peeler.

The automatic loom would be the most economical loom to use for calicoes and similar fabrics. The warp is usually sized, in order to strengthen the yarn. In the sizing process about 10 or 15 per cent of weight of sizing material is added to the yarn, which consists chiefly of wheat flour or potato starch.

FINISHING.

The cloth, after it comes from the loom, is sent to the dyehouse. The first process is to boil it off, after which it is bleached. When the fabric is bleached it is usually printed. It may or may not be piece dyed afterward. The method of finishing or setting the color depends a good deal upon the kind of color used. It may be said, however, that the colors are much faster than they formerly were and for their purposes are usually satisfactory. Calicoes are given what may be termed a "cheap cotton dye." By "cheap cotton dye" is meant that the colors are not fast, but will run or fade somewhat.

Carding and Spinning Particulars.

The yarns that make up calico may be made in either the first or second division of mills, as given in a previous lesson. The counts of the yarns used for the particular fabric for this article are 1-30s, both warp and filling, and these are made out of 1 1-16 inches staple American cotton. After being sampled, several bales are placed around the bale breaker, and fed to this machine, a little from each bale. By doing this a

MORE EVEN YARN

is apt to be obtained. After passing through the bale breaker the cotton is conveyed either by endless lattices or blower and trunking to the cotton bins. As large a mixing as possible should be made at one time. The raw stock for this fabric is put through an opener and three processes of picking. The opener is never allowed to become less than half full when machine is running, for reasons given in previous articles. The beater of this machine runs at a speed of about 900 revolutions per minute. After passing through this machine, which is generally connected directly with the breaker picker, either by trunking or by an

endless lattice, the cotton comes under the action of the feed rolls of the breaker picker, which compress it into a sheet, and it is in this form that it is presented to the beater. For this class of work a

TWO-BLADED BEATER

is used and the speed of the beater at this machine is 1,400 revolutions per minute. The total weight of a lap at the front end is 40 pounds, or about a 16-ounce lap. These laps are put up at the intermediate picker and doubled four into one. The speed of the beater for this machine is about 1,350 revolutions per minute. The total weight of lap at the front is 37 pounds or 12 ounces to the yard. These laps are put up at the finisher picker, and doubled four into one. It is at this point that the cut-roving waste is mixed in with the raw stock in the proportion of three laps of raw stock to one lap of roving waste. It is understood that the bobbin waste has to go through a special process before being mixed with the raw stock. The speed of the beater for this machine is about the same as that of the intermediate picker, 1,350 revolutions per minute. This gives the cotton passing under its action about 42 beats per inch. The total weight of a lap at the front is 35 pounds or a 13-ounce lap. These laps are then taken to the card room, as needed, and put up at

THE CARD.

This card should have a draft not exceeding 100. The cylinder fillet for this class of work should be composed of No. 33 or 100s English count wire, and the doffer fillet and that of the top combs of No. 34 wire or 110s English count. The speed of the licker-in is 300 revolutions per minute, and the top flats make one complete revolution every 50 minutes. The cards should be stripped three times a day, and ground at least once every month, ant set at the time of grinding. Keep parts at the front of card cleaned of all fly and collect the fly from the flats before it accumulates and falls over the doffer or goes up under the flat comb and gets onto the flats. The weight of the sliver at the front should be 65 grains per yard, the production about 750 pounds per week of 60 hours. From the card the sliver is put through

THREE PROCESSES OF DRAWING.

At these machines the doubling is six into one. The draft at the different processes is as follows: Breaker, 4.50; intermediate, 7; finisher, 7.20. The setting of the rolls is as follows: Distance between front and second, 1¼ inches; between second and third, 1⅜ inches; third and back, 1⅝ inches. The front roll makes 400 revolutions per minute. The weight of sliver at the finisher drawing is 72 grains per yard. The drawing sliver is put through the slubber where it is drawn into .60 hank roving. Set rolls as follows: front to second, 1¼ inches; second to back, 1½ inches.

The slubber roving is put through two processes of fly frames at the first intermediate. The hank roving is 2.25 hank and at the next process it is drawn into 6. hank. The lays per inch of the roving on the bobbin at this machine are 33. Look out for the top rolls to see that they are always in the best of condition. From the jack frame the roving is taken to

THE SPINNING ROOM

where it is spun into 30s yarn. The particulars for a warp frame are as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 6½; speed of spindle, 9,800 revolutions per minute; twist per inch, 26.02. The yarn is then taken to the spooler and then to the warper. From the warper the beams are put through the slasher. A good sizing to be used for this fabric is as follows: Water, 100 gallons; cornstarch, 50 pounds; tallow, three pounds; turpentine, one gill. Boil 60 minutes if the cloth is woven on a common loom. If woven on an automatic loom use of water, 100 gallons; potato starch, 50 pounds; tallow, three pounds; turpentine, one gill. Boil 30 minutes.

The filling yarn (30s) is made on a frame fitted as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 6 inches; speed of spindles, 8,300 revolutions per minute; twist per inch, 19.16.

Printing Particulars.

Many of the designs for calicoes and cotton cloth printing are made in Paris, which has been the headquarters for many years of new styles and fashions.

The design is taken by the sketch maker, and drawn to scale, so that the engraver can apply it to the copper roller. Formerly all the printing was by hand (block) printing. Now machines are made to print from one to 24 colors.

A 12-color machine is the largest generally used, but there are a few 24-color printing machines in Europe. Each color has a separate roller and the engraver has to make the pattern fit on every roller, so that when the piece is printed the design is not spoiled and the colors mixed up.

Few realize the accuracy which has to be observed in joining the various patterns so as to produce a complete whole. When a floral pattern is being produced, the various colors must join accurately; that is, a yellow flower must be joined to a green stem or some such method. The green stem cannot be joined to the flower except in one place and have it satisfactory. To those who are familiar with the subject there are quite often intricate patterns noted where the colors do not join accurately; that is, there will be a little streak of white between two colors where they should meet exactly and leave no space between. This is seldom the result of inaccurately made patterns, but rather is the result of the copper rollers being inaccurately spaced.

ENGRAVING THE ROLLERS

is done by hand or machine, by the pantograph or the die machine.

The printing machine turns out about 400 to 800 50-yard pieces a day. There have been times where 1,000 50-yard pieces have been run in 12 hours, a one-color pattern, but for some designs and cloths only 250 pieces are run in a day.

The pieces are singed and bleached, then sheared and brushed to take away all lint from the face of the piece.

The pieces are printed, dried, and steamed to fix the color, afterward soaped and washed, then finished and folded, and made up, ready for the market, being generally packed in 20-piece lots, to be shipped to any point of the compass. There are

MANY STYLES

of calico printing. At present the steam styles are most prominent. The colors are the fastest and brightest to be obtained. The most important styles will now be considered. First in the list are alizarine colors, of almost every hue and shade, reds, pinks, purples, browns, blues, yellows, oranges, etc. Alizarines are fixed on the fibre by chrome mordants.

BLUE.

Three pounds alizarine blue S. paste, 20 per cent; one gallon starch thickening; three pounds acetate chrome, 20 degrees Tw. After printing, the pieces are steamed for one hour, four pounds steam pressure, then soaped and washed.

BASIC COLORS

are good bright, fast colors fixed with tannine: 10 ounces auramine, 1½ pints of water, 1⅛ pints of acetic acid, 10 degrees Tw.; 6 pints gum water, 1 x 1; 2¼ pints acetic acid tannic acid solution, 1 x 1. Steam and run through a bath of tartar emetic; wash and dry. The basic colors are very bright, and consist of every shade in the rainbow.

Extracts of various dyewoods are still used for some styles, fixed with chrome or alumina.

PIGMENT STYLES

are fixed with albumen as vermilion red, chrome green, ultramarine blue, etc. Indigo blue is dyed, then discharged white, yellow, orange and other colors are printed on the dyed pieces. Aniline black is an important style with many resist colors printed first, the black padded afterward and oxidized. This is extensively used.

Patterns are printed on the cloth with mordants of iron and alum. The cloth is then aged and dunged, dyed with alizarine, and the old madder styles produced, which were in such

demand 50 years ago. Then there are Turkey-red styles, with discharge white, yellow, blue, green, black on red ground; discharge white and colors on blues, browns, wines, etc. Indigo blues are dyed in the vat with a large proportion of synthetic indigo and discharges printed on. There is also direct indigo printing with the glucose process.

New styles and combinations of colors are produced every month and faster and brighter colors printed each season.

PERCALE

Percale may be defined as a closely woven fabric, made with a good quality of cotton yarn. Percale is of French origin and was originally made with linen yarn, hence the name, as it is

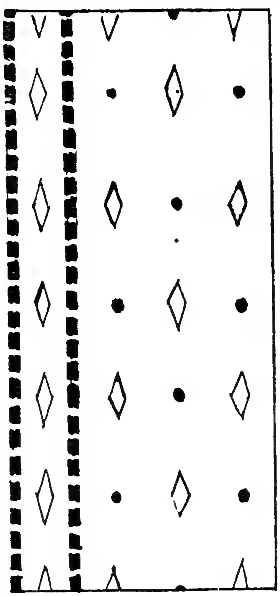


Fig. 1.

sometimes called French cambric.

The finer qualities of percale are used for hankerchiefs, aprons, etc. When used for these purposes they are not printed, but bleached, after the fabrics come from the loom.

Percale, however, is chiefly used for dress fabrics, such as shirt-waist suits for spring and summer wear, and as such, is quite common.

Percale, when intended for dress fabrics, is usually printed on one side with some neat geometrical figure. The printed figure is usually in black, although some may be seen in red or blue. The fabric is bleached before it is subjected to the printing operation.

A CHARACTERISTIC FEATURE of percale is the lack of gloss, or its dull finish, due to the fact that it is not subjected to any pressure during the finishing process. Percales may also be described as plain woven fabrics with a printed design on one side.

The color used for the printed figures is quite durable, in so far that it

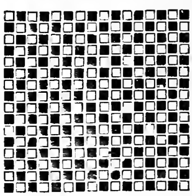


Fig. 2.
Weave.

Fig. 3.
4 Repeats.

will not readily fade and will wear almost as long and well as the fabric.

The printed designs on percales are usually plain but neat geometrical figures. The polka dot pattern is quite common. It produces a very neat effect, especially when dots are in black. Striped designs are also very common. Some very neat effects may be obtained when using a stripe in connection with some simple geometrical figure.

Fig. 1 shows on an enlarged scale a design for a stripe percale. The stripes as a rule run in the direction of the warp. Stripes running vertically

tend to increase the appearance of height, while stripes running horizontally tend to decrease the impression of height; for this reason short persons are advised to select dress goods with the stripe running vertically.

Percale, like most cotton fabrics, is made in several qualities, as regards counts of yarn used, and the number of ends and picks per inch. We will here give an analysis of a good grade:

ANALYSIS.

Width of warp in reed, 38½ inches; width of fabric finished, 36 inches; ends per inch, finished, 85; ends in body of warp, 3,080; 20 ends for selvage; total ends, 3,100.

Take-up of warp during weaving 6 per cent; weight of fabric per yard from loom, 3½ ounces.

Finished weight, 3½ ounces per yard; warp, all 1-30s carded peeler; reed, 1,400x2.

Filling, all 1-36s combed peeler, 74 picks per inch in loom; 74 picks per inch, finished.

LOOM REQUIRED.

Percale, like most cotton fabrics, is woven on looms with high running speed. Percales are plain woven fabrics, consequently no dobby is required. The automatic loom would be the most economical loom to use in the manufacture of percale, or if an automatic loom is not available use any plain weaving loom and draw warp straight on 4 harness. Considerable care should be exercised in the weaving. No broken picks should be allowed to pass, as they will show quite distinctly in the finished fabric.

FINISHING.

After the fabric comes from the loom it is sent to the bleach house, where it is first boiled off. Then it is bleached. After the bleaching process the fabric is ready for the printer. After the printing operation the fabric is slightly stiffened, by being passed through a size trough. The size used for stiffening is usually corn, wheat, rice, barley, potato or farina. Any of these will give the desired effect.

The fabric passes from the sizing trough onto the drying cylinders, after which it is folded; then it is ready for shipment.

Carding and Spinning Particulars.

The counts of yarn of which percale is composed are made in mills of the second division. The counts of yarn vary according to the quality of the cloth. In this lesson we will consider the count of the filling yarn to be 36s and the warp yarn to be 30s. The yarn is carded peeler of 1 1-16th inches staple. The cotton is brought from the storehouse and sampled, and all bales of the same length and grade of staple are placed around the bale breaker. The cotton is fed from each bale alternately to the breaker. From the breaker it is conveyed automatically to the so-called mixing bins, either by endless lattices or a blower and trunking, or a combination of both. The latter method is the better one, because it

HELPS TO DRY OUT

the cotton better. At the mixing bins the sliver waste from all the machines up to the slubber is mixed in. The sliver waste should not be thrown in in long lengths, but should be broken into short lengths, so that it will not become wound around the pin roller of the hopper. The raw stock is next put through a hopper and either two or three processes of pickers. The hopper should be kept well filled so as to insure a uniform amount of cotton always being delivered to the pin roller. This machine is generally provided with a porcupine beater. The cotton is delivered onto an endless lattice, which carries it to the feed rolls of the picker. These feed rolls compress it and present it to the beater. This beater is generally of the rigid type, having two or three arms, generally two.

SPEED OF BEATER.

This beater has a speed of 1,500 revolutions per minute, if of a two-bladed type, or 1,000 revolutions per minute if it has three arms. The total weight of the lap at the front of the breaker picker is 40 pounds or a 16-ounce lap. These laps are put up at

the intermediate picker and doubled 4 into 1. The speed of this beater is about 1,450 revolutions per minute for a two-bladed, or 975 revolutions per minute for a three-bladed beater. The total weight of a lap at the front is 37 pounds or a 12-ounce (per yard) lap. These laps are put up at the finisher picker and doubled 4 into 1. At this picker the cut-roving waste of the same length of staple and cotton is mixed in in the proportion of 3 laps of raw stock to 1 lap of cut waste. The speed of the beater for the machine is 1,200 revolutions per minute for a two-bladed, or 800 revolutions per minute for a three-bladed beater of a rigid type. The total weight of a lap at the front is 35 pounds or a 12½-ounce lap. A variation of one-half pound from standard total weight of lap is allowed at this picker. All laps weighing over 35½ pounds or under 34½ pounds should be run over again. The laps are taken to

THE CARDS,

where the draft should not exceed 100 for this class of goods. The speed of the various parts is as follows: Licker-in, 300 revolutions per minute; cylinder, 160 revolutions per minute; doffer (24 inch), 9¼ revolutions per minute. The top flats have one revolution every 45 minutes. The weight of the sliver at the front should be about 65 grains, and the production about 600 pounds per week of 60 hours. The weight of the sliver at the front of the finisher drawing frame is 60 grains per yard. The speed of the front roll is 350 revolutions per minute. This sliver is next put through the slubber and made into .65 hank roving. This is next put through three processes of

FLY FRAMES,

the hanks at the different processes being as follows: First, 1.80; second, 5.50. There is quite a little variation in the sizes of the roving used for any size of yarn. For any cheap fabric, such as percale, it is the general practice to use as long drafts as possible and get out the largest production of which a machine is capable. It used to be a practice to use single roving for yarns such as are noted in this cloth, but the use of automatic looms and the fact that better results are secured through the use of stronger yarns has now caused a much greater amount of double roving on the spinning frame to be used. From here the roving is taken to either the mule room or the ring spinning room. We will consider that it is taken to the ring spinning room, where the frame for spinning 36s would be as follows: Gauge of frame, 2¾ inches; diameter of ring, 1¼; length of traverse, 5; twist per inch, 27.96; revolutions per minute of spindles, 7,400. After the spinning frame the yarn is carried to the weave room.

The sliver for warp yarn after leaving the card is put through

THREE PROCESSES OF DRAWING

the weight of the sliver at the finisher drawing being 70 grains per yard, the revolutions per minute of the front roll being 350. This is put up at the slubber and made into .50 hank roving, after which the roving is put through two processes of fly frames, the hank roving at each being as follows: 1st, 1.80, and 2d, 5.50. The roving is taken to the spinning room and spun into 30s yarn on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1¾ inches, length of traverse, 6½ inches; twist per inch, 26.02; revolutions per minute of spindles, 9,800. The yarn is next taken to the spooler, then to the warper, and from here to the slasher.

Bleaching and Finishing Particulars.

Percales are very carefully handled in the finishing process.

The goods are bleached in a kier with 4 degrees caustic soda, washed and boiled with another process of 4 degrees caustic soda, washed and chemicked at ½ degree Tw. for six to eight hours, being laid in bins. Then they are scoured with ½ degree sulphuric acid, and well washed and dried. Some finishers place each piece in the kiers separately, and also in chemic tubs and scouring bins, for if sewed in long lengths and run through the machinery in the rope

form the pieces are dragged and the threads are not straight across the piece. Spots and small figures are printed on the goods in navy blue, brown, black, green and other colors.

DARK NAVY.

Eight ounces new fast blue F.; 2 ounces methyl violet 3 R.; 1¼ pints water; 1½ pints acetic acid 10 degrees Tw.; 7 pints thickening; 8 noggins acetic acid and tannic acid (1-1).

DARK ROSE.

Four and one-half ounces rhodamine 5 G.; 3 pints acetic acid 10 degrees Tw.; 5 pints water; 3½ pints mucilage tragacanth (70-1,000); 4 noggins acetic tannic solution (1-1).

IMPERIAL PURPLE.

Four ounces methyl violet 4 R.; 3 pints acetic acid 10 degrees Tw.; 3 pints mucilage of tragacanth (70-1,000); 5 pints water; 2 noggins acetic tannic solution (1-1).

GREEN.

Four ounces malachite green; 1¼ pints acetic acid 10 degrees Tw.; 5 pints gum water (1-1); 4 noggins acetic tannic acid (1-1); 2 pints water.

GRAY.

Two ounces new fast gray; 5 pints mucilage of tragacanth (70-1,000); 3 pints albumen water (1-1); 3 pints water.

The above colors are steamed for one hour with five pounds steam. They are run through a solution of tartar emetic, 2 ounces to gallon, soaped and rinsed, then dried.

STARCHING.

Six to eight ounces white German dextrine, 1 gallon water. Mix cold and boil for 20 minutes. After starching, dry on a tenter frame.

PERCALINE

Percaline, like percale, is a plain woven fabric made with a good quality of single cotton yarn for both warp and filling. The similarity extends no further; the difference between the two fabrics lies chiefly in the weight and finish.

Percaline is a lighter fabric and has a very glossy finish, or, more properly speaking, a moory finish percaline is usually dyed in solid colors. Percale, on the other hand, is a bleached cloth with a dull finish and usually with a printed design on one side.

Percaline is used chiefly for feminine wearing apparel, principally for linings, petticoats, etc. These purposes require that the cloth shall be of solid color, the darker colors being preferred, such as dark blues, dark green and black, which have the greatest sale. It may, however, also be seen in lighter shades, such as a medium blue, a light shade of brown and various shades of tan.

Percaline, as mentioned above, is a plain woven, single-yarn fabric. The

WARP YARN IS SIZED

in order to facilitate the weaving. A fabric like percaline requires very little detail work, as far as the designing is concerned. The most attention is given to the finishing process. In order to get a good glossy finish a certain number of ends and picks per inch are required.

It is important, in laying out the ends and picks per inch, that the de-

B A B A

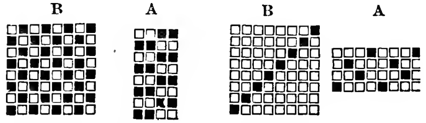


Fig. 1. Fig. 1. Fig. 2. Fig. 2.
Chain Drafts Drawing-in Drafts.

signer bear in mind that unless sufficient yarn is used, the fabric will not acquire the desired effect in the finishing.

This glossy or moory finish is quite a characteristic feature in a percaline. The more ends and picks per inch used, the more gloss the fabric will possess when finished.

ANALYSIS.

Width of warp in reed, 37.5; width of fabric finished, 36; ends per inch, 84; ends in warp, 3,050; 1,400 x 2, reed.

Take-up of warp during weaving, 7 per cent; weight of cloth per yard from loom, 2.5 ounces; weight of cloth per yard finished, 3 ounces; warp yarn, 1-30s combed peeler.

Filling, 1-40s, 84 picks per inch from loom.

Picks per inch finished, 84.

LOOM REQUIRED.

Percaline is woven in the gray on high running speed looms with four or eight harnesses. When four harnesses are used, the warp is generally drawn in the following order: 1, 3, 2, 4. (See Fig. 2A.) When eight harnesses are used, it is drawn straight. (See Fig. 2B.) Fig. 1A.: design for skip draw four harnesses. Fig. 1B: design for eight harnesses straight draw.

The automatic loom would be about the best loom to use, principally on account of production obtained with these looms per weaver.

FINISHING.

The finishing process will include from the time the cloth comes from the loom until it is ready for use.

The first process to which the cloth is subjected is to boil it off, that is, by soaking it in boiling water; this process partially relieves it from any foreign matter that it may have gathered during the weaving and at the same time prepares it for the bleaching process. It is then dyed.

After the fabric is dyed, it is sized in order to stiffen it and also heighten the gloss on the cloth.

After the sizing, it is ready for the calender. In order to still more add to the gloss on the face of the fabric, the cloth is usually doubled lengthwise, or sometimes two pieces are placed together, back to back, and run through the calender at the same time. Before the cloth reaches the calender rolls it passes between two perforated steam pipes, which wet the cloth considerably, then between the rolls of the calender, which are well heated and tightly set together. The above-mentioned processes produce what is termed a moory finish.

The cloth after it comes from the calender is lapped on small boards, after which it is ready for the market.

Carding and Spinning Particulars.

The carding and spinning particulars applicable to the manufacture of percale, given in the last article, may be followed also with reference to percaline, with a few minor changes: Thus the count of the filling yarn is to be 40s, instead of 36s. The filling and warp yarns are both carded peeler, and the cut roving is put through a special process that takes out the twist and delivers it in a fluffy state. This is then put through a picker, which forms it into a lap, and these laps are dealt with as before described. All laps weighing over 35½ pounds or under 34½ pounds should be run through the finisher picker again, being mixed in with the other laps in the proportion of one re-run lap to three regular laps. This is done so that the weight will not vary from the standard. At the cards a 26 or 27 inch doffer should be used if possible, the larger the better, and the production should be 650 pounds per week of 60 hours. The sliver for both the warp and filling yarn is put through three processes of drawing, and the roving to make the warp yarn through two processes of fly frames. The following size mixing may be used at the slasher: Water, 100 gallons; cornstarch, 50 pounds; tallow, three pounds; turpentine, one gill; boil three minutes. The slubber roving for filling yarn is put through three processes of fly frames. We will consider that it is taken to the ring spinning room, where the frame for spinning 40s would be as follows:

Gauge of frame, 2¾ inches, diameter of ring, 1⅝ inches; length of traverse, 5½ inches; speed of spindles, 8,800; twist per inch, 23.72.

After being spun, the filling yarn is treated so that it is delivered to the weave room in a moist state. This is accomplished by different methods in different mills, some using a steam chest, while others simply immerse the filling in water just before it is carried to the weave room.

Dyeing Particulars.

PEARL.

One-quarter per cent diamine dark blue B.; 10 per cent Glauber's; 2 per cent sal soda.

LIGHT TAN.

One-quarter per cent diamine fast yellow B.; ⅛ per cent diamine brown G.; 1-16 per cent diamine black BH.; 10 per cent Glauber's; 2 per cent sal soda.

LIGHT BROWN.

One-quarter per cent tetrazo brown R.; ¼ per cent tetrazo yellow M.; ⅛ per cent tetrazo black N.; 10 per cent Glauber's; 2 per cent sal soda.

LIGHT BLUE.

One-eighth per cent diamine sky blue FF.; 20 per cent Glauber's; 1 per cent sal soda.

LILAC.

One-quarter per cent tetrazo chlorine lilac B.; 10 per cent Glauber's; 2 per cent sal soda.

ROSE.

One-quarter per cent tetrazo chlorine rose; 10 per cent Glauber's; 1 per cent sal soda.

MEDIUM BROWN.

One per cent diamine fast yellow B.; 1 per cent diamine brown B.; ¼ per cent diamine black BH.; 20 per cent Glauber's; 2 per cent sal soda.

ROYAL BLUE.

Three per cent tetrazo brilliant blue BB.; 30 per cent Glauber's; 2 per cent sal soda.

PINK.

One-quarter per cent tetrazo pink GGN.; 20 per cent Glauber's; 1 per cent sal soda.

NAVY BLUE.

Two per cent diamine blue B.; 3 per cent diamine black BH.; 30 per cent Glauber's; 2 per cent sal soda.

DARK GREEN.

Five per cent diamine green B.; 1 per cent diamine black HW.; 30 per cent Glauber's; 2 per cent sal soda.

DARK BROWN.

Two per cent diamine fast yellow B.; 3 per cent diamine brown B.; ½ per cent diamine black BH.; 30 per cent Glauber's; 3 per cent sal soda.

WINE.

Three per cent diamine Bordeaux B.; 30 per cent Glauber's; 3 per cent sal soda.

SCARLET.

Three per cent diamine scarlet B.; 30 per cent Glauber's; 3 per cent sal soda.

BLACK.

Fifteen per cent immedial brilliant black; 15 per cent sulphide sodium; 5 per cent soda ash; 30 per cent Glauber's.

BEDFORD CORD

Bedford cord is a name given to one of the most popular types of fabrics, the distinguishing effect of which is a line stripe and raised cord effect running lengthwise of the cloth, the cords being of more or less prominence.

Figs. 1, 3 and 6 show examples.

They are a standard type and are made in a large variety of weights. The cords vary in width from about 1-20th to ¼ inch. Although usually made with cotton, the name refers to the weave rather than to a combination of weave and material. Sample for Fig. 3 is a worsted bedford cord.

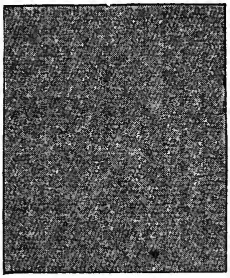


Fig. 1.

The face effect of bedford cords is generally plain, although twill face cords are occasionally made.

Fig. 1 illustrates a plain faced bedford cord, made with weave Fig. 2.

This is the simplest type of bedford cord weave, but is not used to any extent on account of some of the picks, A and B, bringing widely differing proportions of warp and filling on the face from picks C and D, making it hard on a loom.

Fig. 3 illustrates a sample made with

Fig. 2.

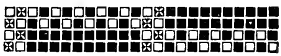


Fig. 4.

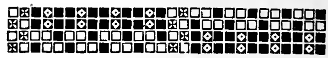


Fig. 5.

Fig. 4. This shows practically the same effect as Fig. 1, but has been made with an easier weave.

Figs. 4 and 5 will serve to show the two principal forms of construction of bedford cords.

Fig. 4 is complete on 24 ends and 4 picks. One repeat of this weave makes two ribs or cords in Fig. 3. The

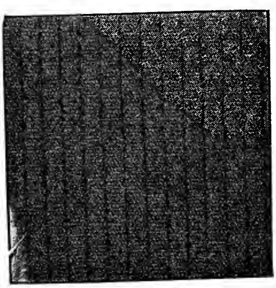


Fig. 3.

line or cut effect is formed by ends 1 and 2, and 13 and 14, shown in type. ⊠ These ends weave plain throughout and have twice as many interlacings as the other ends in each repeat.

The remainder of the ends weave plain on one-half of the picks only, and are then raised out of the way and the filling allowed to float under them for the other two picks, the cords alternating so that when one rib is weaving plain, the same pick of filling is floating under the next one. The plain picks of the succeeding repeat slide over and cover these long floats of filling, making the face effect plain and yet striped.

The advisability of using this type of weave in preference to that shown in Fig. 2 is in the fact that it allows the ends of one cord to be raised out of the way, while the other is weaving plain, and the loom is allowed to raise the same number of ends on each pick.

As every two picks of filling interlace only with the ends of every alternate rib, and float at the back of the next one, solid lines of color lengthwise of the piece may be made by arranging the warp yarns of one rib of one color and those of the other rib of a different color, and picking the filling 2 and 2, so that each color interlaces only with the same color of warp. A variety of colored stripes may be made by combining the types Figs. 2 and 4, varying the number and sizes of sections as desired.

To get extra weight without altering the appearance of the face, extra warp yarns, termed wadding ends, are in-

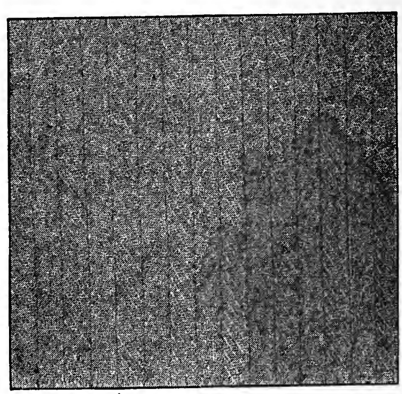


Fig. 6.

serted between the face weave and the filling floating at the back of the rib. When these wadding ends are coarse, they give a pronounced rounded appearance to the cord, more so than if

several ends of finer yarns are used. Wadding ends are generally coarser than the face ends.

Fig. 5 illustrates the type of weave used when a bedford cord is required with a fine face and a heavy weight, or where a well-rounded cord is de-

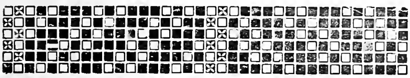


Fig. 7.

sired. Ends shown with type ◘ are wadding ends. These are always raised when the filling is floating at the back of the cord and depressed when the filling is interweaving with the face ends.

Fig. 6 illustrates a bedford cord with a twill weave on the face. The twill runs to the right in one rib and to the left in the next one, making a herringbone effect. Fig. 7 shows the face weave for Fig. 6, ends 1 and 2 and 19 and 20 being the cutting ends.

The weave for this particular sample has been made on the principle shown in Fig. 2, but weave Fig. 8 would be preferable. In this figure type ⊠ indicate cutting ends; ◘ wadding ends; ≡ and solid black type face cord ends; solid type and ⊠ show the face weave. The wadding ends would be drawn 2 in each heddle. There are 12 of these in each rib.

The cutting ends in Fig. 6 might have been arranged to work 2 and 2, instead of plain, because of the large number of picks per inch and the relative amount of interlacing of the other ends. When the face weave is plain, two plain ends should separate the ribs.

Bedford cords are firm fabrics, somewhat heavy on account of the large number of ends and picks required per inch. They are usually woven with a coarse reed in a fairly heavy single box loom. One warp only is required unless the counts of the wadding and face yarns differ.

The question of dividing the two cuttings ends with the reed or of putting them in the same dent depends upon the effect desired and the quality of the fabric. The stripes may be varied in width as desired, or the sizes of the different ribs in one pattern may vary within certain limits.

The construction of samples for Figs. 1, 3 and 6 are as follows:

For Fig. 1, 96 sley, 88 pick; for Fig. 3, 116 sley, 108 pick; for Fig. 6, 220 sley, 156 pick.

No. 6 contains 132 face ends and 88 wadding ends per inch, making a total of 220.

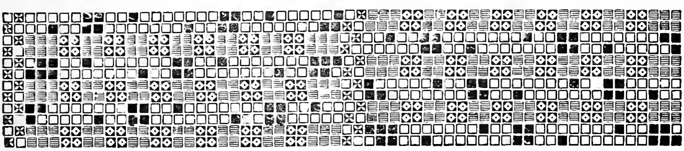


Fig. 8.

Carding and Spinning Particulars.

The machinery for the manufacture of bedford cord will be found in the second and third division of mills, as given in a previous lesson. There are generally three counts of yarn used for each piece of cloth, one for filling, one for the warp, and one for the cords. These counts vary according to the quality of the fabric being made, generally several different qualities being made under one management. The counts of yarn which will be considered in this article as composing the cloth will be number 40s for warp, number 60s for filling and number 20s for the cord or wadding ends. These counts are made up of a good quality of cotton of about $1\frac{1}{8}$ to $1\frac{1}{4}$ inch staple. At the mixing bins the waste sliver up to the slubber is mixed in as collected, which should be done at regular intervals during the day. The one in charge of the picker room should see that too much waste is not being made and also that the sliver is well

torn to pieces before being put into the mixing. A good way to check how much waste is being made is to have the picker man weigh it as it comes in and at the end of every week give his list to the overseer. In this way the overseer may be sure that he is getting a correct list of the amount of waste being made and can act accordingly. The raw stock is put through either two or three processes of picking,

TWO PROCESSES OF PICKING

being generally used, although the particulars for three processes will be given here. The raw stock is fed to the hopper and from here passes under a beater, the speed of which is 1,050 revolutions per minute. From here it is conveyed to the feed rolls of the breaker picker, in a fluffy state, by an endless lattice. The feed rolls condense it and present the sheet of cotton to the action of the beater, which is generally of the rigid type, having either two or three arms. If a two-armed beater is used, the speed should be about 1,500 revolutions per minute and if a three-bladed beater, the speed should be proportionately less. The total weight of the lap at the front should be about 40 pounds or a 16-ounce lap. These are put up at the intermediate picker and doubled 4 into 1. The speed of this beater should be about 1,400 revolutions per minute, the total weight of the lap at the front being 35 pounds or a 14½-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. It is at this point that the

CUT-ROVING WASTE

is mixed in, it having first been made into a lap after passing through a special process, in the proportion of one lap roving waste to three laps raw stock. The speed of this beater, if of a two-bladed rigid type, should be about 1,350 revolutions per minute, which gives the cotton passing through it about 40 beats per inch. The total weight of the laps at the front should be about 35 pounds or a 12½-ounce lap. A variation of half a pound either side of standard is allowed. Laps with a variation of more than the above should be treated as given in a previous article. The laps are put up at the card, the draft of which should not be less than 100. The speed of the top flats should be one complete revolution every 45 minutes. The wire fillet used should be of medium fineness, about number 110 for cylinder and number 120 for the doffer and top flats.

THE WEIGHT OF SLIVER

at the front should weigh 65 grains per yard, the production for the 40s and 60s yarn being 650 pounds per week of 60 hours, and for the 20s yarn 750 pounds per week. This sliver is put through three processes of drawing, six ends up, the revolutions per minute of the front roll being 400 at the finisher drawing. The weight at the finisher drawing should be 70 grains per yard. The drawing should be sized three times a day, and if the variation is more than one grain per yard, the draft gear should be changed to keep the drawing at standard weight. The drawing sliver is put through the slubber and made into .50 hank roving.

FLY FRAMES.

The roving for 40s and 60s yarn is run through three processes of fly frames and for 20s is run through two processes. For 60s yarn the different hanks at each process are as follows: First intermediate, 1.50; second, 4; jack, 12 hank. For 40s yarn the details are as follows: First 1.40; second, 3.40; jack, 8. For 20s yarn: First, 1.50; second 4.50. The warp yarns are frame spun and for 40s use a frame the same as given in a previous lesson. For 20s use a frame having a gauge of 2¾ inches; diameter of ring, 2 inches; length of traverse, 7 inches.

The filling yarn may be either mule or ring spun; if the latter use a frame having a gauge of 2¾ inches; a diameter of ring, 1¾ inches; length of traverse, 5½ inches; revolutions per minute of spindles, 8,000. The warp yarn is put through the spooler, warper and slashing machines and then is ready for the loom.

A great many mills comb their filling for weaving bedford cords.

Dyeing Particulars.

SLATE.

Two per cent immedial black NB.; 2 per cent sodium sulphide; 2 per cent soda ash; 20 per cent Glauber's salt.

PEARL.

One-half per cent immedial direct blue B.; ¼ per cent immedial black NB.; 1 per cent sodium sulphide; 2 per cent soda ash; 20 per cent Glauber's salt.

BROWN.

Three per cent immedial cutch O.; 5 per cent immedial brown RR.; ¼ per cent immedial black NB.; 9 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt.

BLACK.

Fifteen per cent immedial black NN.; 15 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt.

BOTTLE GREEN.

Eight per cent immedial dark green B.; 1 per cent immedial yellow D.; 9 per cent sodium sulphide; 30 per cent Glauber's; 3 per cent soda ash.

NAVY BLUE.

Four per cent immedial indone B.; 4 per cent immedial indone R.; 8 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's.

RED.

Six per cent benzo fast red 4B.; 30 per cent Glauber's salt; 3 per cent sal soda.

PINK.

One per cent erika pink; 2 per cent sal soda; 20 per cent Glauber's salt.

SKY BLUE.

Four per cent tetrazo sky blue F.; 2 per cent sal soda; 30 per cent Glauber's salt.

IMPERIAL PURPLE.

On a tannine and tartar emetic mordant. Dye 2 per cent methyl violet 2 R.

CHINTZ

Chintz is a fine, soft, cotton fabric, printed with elaborate designs of flowers and foliage in several colors. The fabric is used principally for household purposes such as lambrequins, coverings, etc. It is also utilized for such purposes as masquerade dresses and the like.

Chintz is but a plain woven fabric, elaborately ornamented with designs by means of the printing machine, several different colors being employed. From this point of view we will consider the fabric.

There is practically no combination of colors that may not be used for the ornamentation of a fabric of this description. However, the high-colored designs are most popular. Following are

POINTS TO CONSIDER

in planning a design for chintz, also colors to use. In the first place it is necessary to have a clear idea of what the main characteristics of the design are to be, before the work of arrange ment is begun. The character of the design should be influenced largely by the purposes the fabric is intended for; this brings in the question of fitness, which is the application of a certain class of design to certain materials. It is evident that the style of design that would be suitable for a floor covering would be entirely unsuitable for a printed cotton fabric. The consideration of style is a subject that the designer is bound to be governed by, simply because the designs are for a commercial purpose; consequently in planning a design, the style, scale and character of the design, the material it is to be applied to, and its purposes should be understood by the designer. Chintz is

A PURELY ORNAMENTAL FABRIC.

They, therefore, may be rich, both in colors and design. In Figure 1 we give an idea of the character of design used for fabrics of this description. The ground may be a light shade of blue, the leaves and stems in two shades of green, while the flowers may have three shades of red graduating from pink to dark red; a happy blending of color is essential to the well-being of a design.

ANALYSIS.

	Inches.
Width of warp in reed	36½
Width of fabric finished	35½
Ends per inch finished	72
Ends in warp	2,556
Selvage	24
Total ends in warp	2,580

Reed 1,250x2

Take-up of warp during weaving, 5 per cent; weight of fabric finished, 1½ ounces per yard.

Warp yarn 1-44 cotton.

Filling 56 picks—1-80 cotton.

LOOM REQUIRED.

Chintz is usually woven on high running speed looms. The warp is drawn in on eight harnesses. The warp yarn is well sized so as to avoid breakages of the warp in the weaving.

FINISHING.

The fabric, after it comes from the loom, is sent to the printing house, where it is boiled off and bleached preparatory to the printing operation; chintz is not dyed; all the colors are applied by means of the color rolls in the printing machine. Several rolls are required, each roll having a separate portion of the design and likewise a separate color.

After the printing, the fabric is passed through a calender press, the rolls of which are well heated and tightly set, which gives the glazed finish which the fabric possesses.

Carding and Spinning Particulars.

The yarns of which chintz is composed are made in mills having the second division equipment of machinery. The yarns which make up the sample under description are as follows: filling yarn No. 80s and warp yarn 44s. The filling yarn is made of good cotton of 1⅝-inch staple. This is put through a bale breaker, as has been previously described. Either two or three processes of picking may be used, many overseers claiming the two-process method to be the better.

The raw stock, after being allowed to stand in the mixing bin as long as possible to dry out, is put into the hopper of the opener, and after being lifted up by the spiked apron comes in time under the action of the beater. This beater is provided with four arms, the blades of which are composed of leather. The speed of this beater for this kind of stock is 1,000 revolutions per minute.

THE RAW STOCK

is then passed to the breaker picker by an endless lattice. This lattice should be varnished frequently so as to make it smooth. This not only applies to this lattice, but to all lattices in the picker room. The feed rolls of this machine compress the cotton into a condensed sheet and it is struck from these rolls by a beater. This is generally of a rigid type, having either two or three arms; if of two-blade type it makes about 1,500 revolutions per minute. The laps at the head end weigh 40 pounds or a 16-ounce lap. These laps are put up at the intermediate and doubled 4 into 1. The speed of this beater is about 1,400 revolutions per minute, the total weight of the lap being 37 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. It is at this point that the cut roving is mixed in, as has been described in a previous article. The speed of this beater is 1,350 revolutions per minute if of a rigid two-bladed type; if the beater has three blades it rotates proportionately slower. The total weight of a lap at the front is 39 pounds or a 12-ounce lap.

THE EVENNESS OF WORK.

Look out to see that the eveners on all the pickers are in proper working order, for remember the greater part of the evenness of a lap depends upon this part of the picker. See that the drafts are properly directed and of the right strength to do the most good. Keep the fly well cleaned out from under the machines and don't be afraid of oil, but get it in the proper place. Be sure and have everything neat and clean. The laps are put up at the card. It has always been a bone of contention whether it is proper to use a heavy lap and slow speed or light carding and higher speed. Heavy carding means low drafts, and light carding, so-called, high drafts. For this lesson light-weight carding will be used. The draft of the card should be 115, which gives a 45-grain sliver.

The speed of the flats should be one complete revolution every 40 minutes. The speed of the licker is 350 revolutions per minute. Strip three times daily and clean thoroughly twice a day. Keep front of card free from fly waste all the time. The production of the card for a week of 60 hours is 550 pounds. This is put through

THREE PROCESSES OF DRAWING,

the weight of the sliver at the finisher being 60 grains per yard. The speed of the front roll is 400 revolutions per minute. The top rolls of a drawing frame should always be kept well varnished, the leather being free from flutes, ridges, nicks; in fact, they should be in perfect shape. The drawing sliver is next put up at the slubber and made into .55 hank roving. This is put through three processes of fly frames, the hank roving at each process being as follows: First, 1.50 hank; second, 4.80 hank; fine or jack, 16 hank. This roving may be taken to either the mule or ring spinning room. If to the latter, use a frame having the following particulars for spinning 80s yarn: Gauge of frame, 2¾ inches; diameter of ring, 1¼; length of traverse, 5 inches; revolutions per minute of spindles, 7,400; twist per inch, 29.07. The

YARN AFTER BEING TREATED

in some manner to make it damp, is carried to the weave room. What has been said of the cotton for the filling yarn may also apply to the warp yarn with the following exceptions: In the picker room, length of staple, 1⅜ inches; weight of lap at finisher picker, 40 pounds. In card room at the cards, draft not over 105; speed of flats, one revolution in 50 minutes. Production 675 to 700 pounds, at drawing frame, weight of sliver, 70 grains per yard; at slubber a .50 hank roving, which is put through three processes of fly frames, the hank at each being as follows: First, 1.50 hank; second, 4 hank; fine, 10 hank. This is carried to the ring spinning room and made into 40s yarn on a frame with the following particulars: Gauge of frame, 2⅜ inches; diameter of ring, 1½ inches; length of traverse, 6 inches; revolutions per minute of spindles, 10,000; twist per inch, 29.65. The yarn is then spooled, beam warped, and these are run through the slasher, where the requisite number of ends is run on a warp beam at the head end. A good size mixing is as follows: Water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds; soap (white), 1½ pounds; paraffine wax about 1 pound.

Printing Particulars.

The colors for this style of goods are mostly light, bright shades.

LIGHT BLUE.

Two ounces methyl blue B.; 1 pint acetic acid, 10 degrees Tw.; 2 pints water; 6 pints gum water, 1 : 1; ¼ pint acetic acid tannic acid solution, 1 : 1.

LIGHT GREEN.

One and one-half ounces brilliant green crystals; 1 pint acetic acid, 10 degrees Tw.; 2 pints water; 5 pints gum water, 1 : 1; ¼ pint acetic acid tannic acid solution, 1 : 1.

LIGHT PINK.

One and one-half ounces rhodamine 5 G.; 3 pints water; 1½ pints acetic acid, 6 degrees Tw.; 3 pints tragacanth solution, 70-1,000; ½ pint acetic acid tannine solution, 1 : 1.

RED.

Six ounces rhoduline red B.; 2 pints water; 1½ pints acetic acid, 10 degrees Tw.; 6 pints gum water, 1 : 1; 1½ pints acetic acid tannine solution 1 : 1.

LIGHT MAUVE.

One-half ounce methyl violet 6 B.; 2 pints water; 1½ pints acetic acid, 10 degrees Tw.; 6 pints gum water, 1 : 1; ¼ pint acetic acid tannine solution, 1 : 1.

ROYAL BLUE.

Six and one-half ounces Victoria blue B.; 1½ pints acetic acid, 10 degrees Tw.; 2½ pints water; 6 pints gum water, 1 : 1; 1½ pints acetic acid tannine solution, 1 : 1.

LIGHT YELLOW.

Five ounces duramine II.; 1¼ pints acetic acid, 10 degrees Tw.; 1¼ pints

water; 6 pints gum water; 1 : 1; 1¼ pints acetic and tannine solution 1 : 1.

ROSE.

Four ounces rhodamine 6 G.; 4½ pints water; 3 pints acetic acid; 9 degrees Tw.; 3½ pints tragacanth solution, 70-1,000; 1 pint acetic acid tannine solution, 1 : 1.

LIGHT BROWN.

Six ounces Bismarck brown G.; 2 pints acetic acid, 10 degrees Tw.; ¼ pint glycerine, 45 degrees Tw.; 2½ pints water; 6 pints gum water, 1 : 1; 1 pint acetic acid tannine solution, 1 : 1.

LIGHT OLIVE.

One pint of the light yellow color; 1 pint of light brown color; ¼ pint light green color; well mixed and strained through a cloth. With different proportions of these colors any shade can be obtained.

These colors are well mixed in a tub or copper pan, strained through a cloth, and printed in a printing machine. The pieces are dried, steamed one hour, without pressure, passed through a bath of tartar emetic, soaped at 90 degrees F., washed and dried.

The pieces are then run through a starch mangle and starched, then calendered to finish required.

ORGANDIE (Plain and Figured)

An organdie may be defined as a very fine translucent muslin, used exclusively for dress goods.

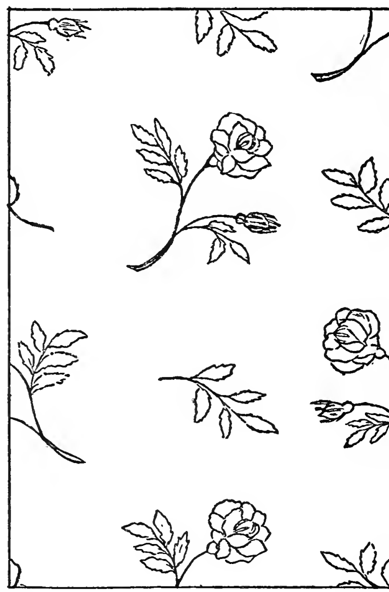
The fabric is made in a variety of qualities as regards the counts of yarns used. This naturally influences the number of ends and picks per inch in the fabric. The fabric is also made in a variety of widths, ranging from 18 to 60 inches.

The fabric, as already mentioned, is used exclusively for dress goods. The plain organdie is very popular in pure white or bleached, although considerable quantities are dyed in solid colors of light shades, such as pale blue and various pinks, while the figured organdie is usually bleached, then printed with small floral designs. The printed design is usually in from two to four colors and in delicate shades in conformity with the material.

The design itself is also quite delicate.

In a design for a fabric of this character, the scale of the pattern should not be too large. It should not exceed 4½ inches in the repeating of it, as the folds of the dress and the numerous seams would destroy the effect of the repeat if it were much larger.

The accompanying sketch shows a design for the fabric in question; the



design shows a rose spray rendered in a natural manner. A color scheme for the same would be to have the flowers pink or yellow, while the leaves and stems may be in green; this against a white ground should give a pleasing effect. A delicate design and color scheme are essential for this kind of fabric. Organdie, considered in relation to cost, as a wearing material is quite an expensive fabric; however, the retail price apparently seems to disprove this fact. Our reason for the statement that the fabric is not an inexpensive material is that it has a

finish peculiar to itself, so that when subjected to soap and water it will not have the same appearance as before. It loses its crisp feeling entirely; consequently an organdie is worn by many until soiled, then discarded.

ANALYSIS.

Width of warp in reed, 32 inches; width of fabric finished, 30½ inches; ends per inch in reed, 76; ends in warp, 2,440; ends per inch finished, 80. Reed, 1,400x2.

Take-up of warp during weaving, 7 per cent; weight of fabric, about 15 yards to one pound.

Warp yarn, 1-80 combed Sea Island. Filling, 1-20s combed Sea Island; 88 picks per inch.

LOOM REQUIRED.

Organdie is but a plain woven fabric. The ornamentation of the figured fabric is effected by means of the printing press; consequently any smooth running high speed loom may be used in the weaving of this cloth. However, as the Northrop loom with warp stop motion would answer best, the warp may be drawn in straight on eight harnesses; in using a considerable number of ends per inch, it is safe to use at least eight harnesses, so as to avoid heddle chafing.

The warp preparatory to weaving is given a fair sizing with white gum in order to give it strength.

FINISHING.

The fabric is stiffened by sizing it with such ingredients as dextrine, dul cine, albumen, casein, etc., after which it is run through the calender, which slightly glazes the surface of the fabric, thus completing the finishing process.

Carding and Spinning Particulars.

The yarns of which organdies are composed require the equipment of machinery found in the second or third division of mills, as given in a previous lesson. This class of goods requires a very fine grade of cotton, and generally both warp and filling yarns are made of combed stock. The counts of yarn vary, according to the grade of goods to be made. In this article it will be considered that the make-up of the cloth is as follows: 80s warp and 120s filling yarn. These are made from Sea Island stock of $1\frac{5}{8}$ to $1\frac{3}{4}$-inch staple. Sea Island cotton as a whole requires just as little picking as possible and still get the dirt out. Sea Island cotton is generally put through an opener and one process of picking although some overseers use two processes. This stock is not put through the bale breaker, but is

GENERALLY MIXED BY HAND.

If any bales are found which are not up in grade and staple they should b placed one side and not put into the mixing. The mixing should be mad from several bales at once, so as to ge the mixing as even as possible. A this point the sliver waste from the machines up to the slubber is mixe in. The sliver should be pulled into short lengths so that it will not be s apt to become wound around the pin beater of the opener. The hoppe should be kept more than half full The cotton is passed from this machine directly to the finisher picker the apron of this picker is divided up into yard lengths and the loose cotton is spread evenly over it. About 10 ounces to the yard is the weight used. The beater for this class of goods is generally of a rigid two-bladed type, the speed of it being less than those that have been previously given. The speed of the beater is about 1,200 revolutions per minute, which gives the cotton of this length passing through the picker about 29 beats per minute. The total weight of the lap at the front of picker is 30 pounds, or a 10-ounce lap. The usual points that have been previously given should be looked out for and in addition the

SPEED OF THE BEATER

should be watched to see that it is not putting neps into the cotton. These laps are put up at the card, the draft of which should be high, not less than 125 and on some Sea Island stock the draft runs as high as 180. The card wire fillet used on the cylinder should be No. 120s (English count) and for the doffer and flats 130s. The flats should be speeded up

to take out more flat waste or, in other words, the card with 110 flats should make one revolution every 35 minutes. The flats are speeded up by lagging the flat pulley on the main cylinder shaft. Close settings should be used and these should be gone over every time the card is ground, which should be once every month. Grind lightly. Strip three times a day and keep the cards clean, especially the fronts. The weight of the sliver at the front should be about 45 grains per yard and the production about 225 to 300 pounds per week of 60 hours Be sure that the feed plate is set at the proper distance from the licker-in, so that the staple will not be broken. On most makes of cards the licker-in is speeded too high for this class of cotton, and better results will be obtained if the speed is dropped to 275 and not more than 300 revolutions per minute. It is claimed that a high speed of the licker-in tends to put neps into the cotton of long staple.

THE LICKER-IN

should be speeded so as to tear the sheet or lap apart and take out the seed, etc., left by the picker. The cotton is next taken to the sliver lap machines and made into a lap. The weight of the lap should be about 300 grains per yard. The doublings at the sliver lap are 14 into 1 when 6-head 9-inch lap combers are used, or 20 into 1 when 8-head 10½-inch laps are used. The laps from the sliver lap machine are doubled 6 into 1 at the ribbon lap machine, the weight of laps per yard being 280 grains. These laps are put up at the comber. The doublings at the comber depend on how many heads it has. For the past two or three years the comber builders have sold practically nothing but 8-head combers, so we will consider that the mill is equipped in this manner. The doublings would then be 8 into 1. For this class of goods from 22 to 25 per cent waste is taken out and the weight of the sliver at the front is 48 grains. This is put through two processes of drawing, the weight at the front of the finisher drawing being about 60 grains per yard.

Be sure to keep the top leather rolls well varnished and in good condition. See that all parts of the machine are working properly.

The sliver is next put up to the slubber and made into .80 hank roving. In some mills the top leathers are varnished and in addition to this, on long-staple stock, larger top rolls are used.

This roving is put through three processes of fly frames for 120s filling yarn, the hank roving at each process being as follows: At the first intermediate 2.25 hank, at the second intermediate 6.50 hank and at the fine frame 24 hank. On this hank roving it is a good plan to either have self-weighted rolls on second intermediate and fine frames or run them without weights, all the weight being on the back top roll. The roving is then spun on a mule into 120s.

The slubber roving for the warp yarn is put through three processes of fly frames, the hank roving being as follows: At the first, 2.25; at the second, 5 hank, and the jack, 16 hank Keep the top leather rolls in good condition and watch the traverse motion. Look out for twist and don't get too much tension, so as to pull the roving when it is between the boss of the front roll and the flyer, as this tends to cause uneven roving. Don't let the hands cut the roving from the bobbin, and weigh the cut roving. This roving is taken to the ring spinning room and spun into 80s yarn on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1⅝ inches; length of traverse, 5¼ inches; twist per inch, 39.08; speed of spindles, 9,600. From here it passes through the spooler and warper, and the beams for this machine are put up at the slasher, and after passing through this machine the required number of ends are run on to a warp at the front end.

A GOOD-SIZED MIXING

for 80s yarn, if sley and pick are high, is as follows: Water, 100 gallons; potato starch, 70 to 75 pounds; tallow, 7 pounds; Yorkshire gum, 3 pounds; soap (white), 2 pounds. Boil 2 hours

and let stand 10 hours before using Keep agitator running and keep size mixing almost at boiling point.

Dyeing Particulars.

Following are dyeing particulars for organdie:

PINK.

Two ounces rhodamine pink 6 G.; 1 qt. water; 1½ pints acetic acid 90 degrees Tw.; 3 pints tragacanth solution 70 : 1,000; ¾ pints acetic acid tannine solution .1 : 1.

LIGHT YELLOW.

Four ounces thioflavine T.; 2 qt. water; 1½ pints acetic acid, 6 degrees Tw.; 3 pints tragacanth solution .70: 1,000; 1 pint acetic acid tannine solution 1 : 1.

PEACOCK BLUE.

Four ounces turquoise blue G.; 2 qt. water; 2 pints acetic acid, 9 degrees Tw.; 3 pints tragacanth solution 70 : 1,000; 1¼ pints acetic acid tannine solution 1 : 1.

ROSE.

Four ounces brilliant rhoduline red B.; 2 qt. water; 1½ pints acetic acid, 6 degrees Tw.; 3 pints tragacanth solution 70 : 1,000; 1¼ pints acetic acid tannine solution 1 : 1.

BLUE.

Four ounces methylene blue B B.; 2 qt. water; 2 pints acetic acid, 9 degrees Tw.; 2 pints tragacanth solution; 1½ pints acetic acid tannine solution 1 : 1.

GREEN.

Four ounces emerald green crystals; 2½ pints water; 2 pints acetic acid, 6 degrees Tw.; 3 pints tragacanth solution 70 : 1,000; 1½ pints acetic acid, tannic acid solution 1 : 1.

LIGHT BROWN.

Four ounces Bismarck brown B.; 1 qt. water; 2 pints acetic acid, 9 degrees Tw.; 3 pints tragacanth solution 70 : 1,000; 1½ pints acetic acid tannic acid solution 1 : 1.

SAGE GREEN.

Mix together one gallon green color; ¼ gallon light yellow; ½ gallon light brown.

VIOLET.

One ounce methyl violet 4 B.; 1 qt. water; 1½ pints acetic acid, 6 degrees Tw.; o pints gum water 1 : 1; ½ pint acetic acid tannine solution 1 : 1.

SLATE.

One gallon blue color; 1 pint light yellow; well mixed with ½ gallon tragacanth solution 70 : 1,000.

The color is then strained through a cloth, and is ready to print. All the colors are well boiled in a copper pan and strained through a cloth. After the printing process, they are dried, steamed one hour without pressure, passed through a bath of tartar emetic, and soaped at 90 degrees F., rinsed and dried. The goods are starched and finished on a tenter frame.

ALBATROSS CLOTH

Cotton albatross cloth is a plain fabric made in imitation of a worsted fabric of the same name. It is light in weight, and is used principally for dress goods. It is sometimes used instead of bunting for railroad flags. The ends and picks per inch are few and the width of the cloth is narrow

The items of construction for a cotton albatross are as follows: Warp, 1,024 ends of No. 28s cotton; 16 ends have been allowed for selvages.

Filling, 48 picks per inch of No. 36s cotton; 48 sley reed.

Width in reed, 23 inches.

Width finished, 21 inches.

This fabric can be made very readily on an automatic loom, or on any of the light, fast running, single box cotton looms, four wire heddle harnesses, or the regular twine harnesses, on the plain cotton loom only being required. If wire harnesses are used on a cam loom, the ends should be drawn through the heddles, 1, 3, 2, 4.

Being considered a fair quality of cloth, it is necessary to match the pick when weaving it.

The goods are finished by being burled, sheared, washed, singed, bleached, dyed, rinsed, dried and pressed; care being taken not to press them too hard.

The singeing process is sometimes omitted.

Albatross cloth is generally sold in white, black, or solid colors, being piece-dyed. It is not used to any extent for printing purposes.

Carding and Spinning Particulars.

The yarns for albatross cloth are made in mills having the equipment of machinery found in the second division of mills, as given in a previous lesson. For this article we will consider the filling yarn to be number 36s. This would be made of 1 1-16-inch staple American cotton. The warp yarn is 28s count and may be made from the same state and grade of cotton. The mixing is done either by hand or by a bale breaker. The cotton, if mixed in the former manner, should be allowed to stand longer than if mixed by the latter method. This is to allow the cotton

TO DRY OUT.

At this point the good sliver waste from machines up to the slubber is mixed in, care being taken that the sliver is broken up into short lengths. The cotton is next put through an opener and either two or three processes of picking (generally three). The opener hopper should be kept at least half full in order to always have an even amount of cotton fed to the breaker picker. This picker is generally provided with a two-bladed, rigid beater, which rotates at a speed of 1,400 revolutions per minute. The

TOTAL WEIGHT OF LAP

at the front end of this picker is about 40 pounds or a 16-ounce lap. These are put up at the intermediate picker and doubled four into one. This is also provided with a two-bladed, rigid type of beater, the speed being 1,500 revolutions per minute. This style of beater is not always used, as will be noted later. The total weight of lap at the front is about 38 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled four into one. At this point the laps of cut-roving waste are mixed in in the proportion of one lap of cut roving to three laps of raw stock. The cut roving is treated as before stated.

THE FINISHER PICKER

is equipped with either a rigid or what is called a pin beater. A great many mills are putting in this pin beater on stock up to 1 9-16 inch, claiming that the stock is more thoroughly cleaned. The speed of the pin beater (which has three arms) is higher than that of the rigid type, being 1,500 revolutions per minute, whereas a two-armed, rigid type would be run about 1,450 revolutions per minute. The pin beater can be run at a greater speed because it does not strike the cotton a blow but rather tears it apart. If a two-bladed, rigid type of beater is used, it should be speeded up so as to give about 42 beats to each inch of cotton passing through. The total weight of lap at the front should be about 38 pounds. Laps varying more than one-half a pound either side of this standard should be run over again. Observe the general points about the picker room that have been given before. The laps are put up at the card. For this grade of goods

THE DRAFT

should not be less than 100. Use medium wire filled, i. e., No. 120s, for cylinder and No. 130s for doffer and flats. Speed of licker-in, 320, flats one revolution every 45 minutes; use 26-inch or large diameter doffer. Strip three times a day and grind cards all over once a month. Groove setting points frequently and watch the dead roller grinding wheel to see that it is straight.

The weight of the sliver at the front should be about 65 grains, the production being 700 pounds per week of 60 hours. The card sliver is put through three processes of drawing, the weight at the front being 70 grains per yard.

WATCH THE CLEARERS

to see that they are in proper condition. Metallic rolls may be used on this class of work to great advantage. If leather top rolls are used, keep them up in good shape. The drawing sliver is run through the slubber and made into .55 hank roving. This is

put through three processes of fly frames for the filling yarn, the hank roving at each process being as follows 1st, 1.50; 2d, 3.50, and jack, 8.25 hank.

We will consider that the filling yarn is taken to the ring spinning room, where it would be spun in 36s yarn on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 5½ inches; speed of spindles, 8,900 revolutions per minute. After being treated to make it damp, the filling is taken to the weave room and woven as given above. The roving for the warp yarn is put through two processes of fly frames, the hank roving at the first intermediate being 1.75 and at the jack 5.50 hank. This yarn is spun into 28s yarn on a ring frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1¾ inches, length of traverse, 6½ inches; speed of spindles, 9,700 revolutions per minute. The warp yarn is then taken to the spoolers; from here to the warpers, and the warps are put up at the slasher, the required number of ends being run upon a beam at the head end.

Dyeing Particulars.

LIGHT PINK.

One-half pound Erika pink; 20 pounds Glauber's; 2 pounds sal soda.

SKY BLUE.

One pound diamine sky blue FF.; 20 pounds Glauber's; 2 pounds sal soda.

LIGHT SLATE.

One per cent katigen blue black B.; 3 per cent soda ash; 20 per cent Glauber's; 1 per cent sodium sulphide.

OLD GOLD.

Two per cent diamine catechine 3 G.; 2 per cent diamine fast yellow B.; ⅛ per cent diamine black BH.; 30 per cent Glauber's; 2 per cent sal soda.

LIGHT SAGE GREEN.

One-half per cent chloramine yellow M.; 116 per cent benzo fast orange S.; ⅛ per cent benzo fast blue BN.; 30 per cent Glauber's; 2 per cent sal soda.

LIGHT BROWN.

One-half per cent diamine brown B.; ½ per cent diamine fast yellow B.; ¼ per cent diamine catechine 3 G.; 20 per cent Glauber's; 2 per cent sal soda.

LIGHT GREEN.

One per cent diamine sky blue FF.; 1 per cent diamine fast yellow FF.; 30 per cent Glauber's; 2 per cent sal soda.

PEARL.

One-quarter per cent immedial direct blue B.; ¼ per cent immedial black NG.; ¾ per cent sodium sulphide; 20 per cent Glauber's; 2 per cent soda ash.

BLACK.

Fifteen per cent immedial black NN.; 15 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's.

NAVY BLUE.

Twelve per cent thiogene blue B.; 22 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's.

DARK BROWN.

Ten per cent thiogene brown G.; 6 per cent sodium sulphide; 30 per cent Glauber's; 3 per cent soda ash.

BOTTLE GREEN.

Ten per cent pyrogene green B.; 12 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's.

ROSE.

Mordant for 200 gallons water; 3½ pounds tannic acid; run through, on jig machine for one hour. Pass through a clean bath of two pounds tartar emetic for 200 gallons water half hour; wash and dye. Two pounds rhodamine 5 G.

ROYAL BLUE.

Mordant as rose. Dye, 1½ per cent Victoria blue B.

ROYAL PURPLE.

Mordant as rose. Dye, ¾ per cent methyl violet R.

TARLATAN

Tarlatan is a fine, open, transparent muslin, somewhat similar to an organdie in the feel and finish, though a much coarser fabric. The cheaper grade of tarlatan resembles mosquito netting. Mosquito netting, however, is a leno weave, while tarlatan is but a plain woven fabric. The goods are piece dyed and may be seen in any color; some are finished in pure white

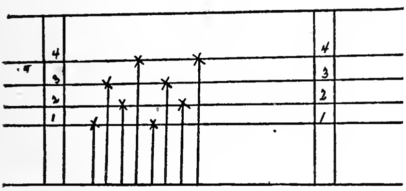


Fig. 1. Drawing-in Draft.
(2 repeats.)

or bleached. The fabric is used for various purposes, the finer qualities for women's wear. The fabric is principally used for draping and decorating purposes, for foundations for ladies' hats, for bunting around bird cages, for a twofold purpose—first to prevent the birdseed from being scattered to the floor, and second, as a decorative feature. Briefly we may say that the fabric is intended chiefly for draping and decorating purposes, especially the cheaper grades, the meshes of which are so open that hardly any lady would care to wear a dress made of it, unless she were anxious to exhibit the garments which she would be obliged to wear under it. The grade of tarlatan under consideration, of which an anaylsis will follow, is entirely too flimsy for a dress fabric. If the goods are taken between the thumb and forefinger with any degree of firmness and the surface of the fabric is drawn between them, the threads will readily give, or leave their original place. This would certainly be a poor feature in a fabric intended for dress goods. The fabric is woven in comparatively wide widths; the coarser qualities are commonly 58 inches in reed including selvage. The selvage is about $\frac{3}{8}$ of an inch, two ends in one heddle, while the body of goods is drawn one end in one heddle, and each end into a separate dent in the reed.

Fig. 2.

The goods in weaving have a tendency to roll up, that is, the selvages roll toward the middle of the fabric; this is overcome by holding out the selvages by means of the temple. The temple also prevents the chafing of the warp during weaving.

LOOM REQUIRED.

Any light-built loom with a comparatively high running speed will answer for weaving tarlatans, providing it is wide enough in the reed space. The warp is usually drawn in on four harnesses, in the following order: 1, 3, 2, 4, the chain being built accordingly so as to give a plain weave. The warp is sized before it is put on the warp beam.

ANALYSIS.

Width of warp in reed, 58 inches. Finished width, 52½ inches; ends per inch finished, 20; picks per inch finished, 18.

Reed, 650 x 1.

Ends in warp, 1,010; 80 ends selvage, two ends in one heddle; total, 1,090 ends.

The take-up during the weaving is very little; the take-up in the finished goods about 1 per cent. After the fabric is finished the threads lie practically straight; this is due to the openness of the mesh. This readily illustrates that the closer the weave, the more take-up of warp yarn.

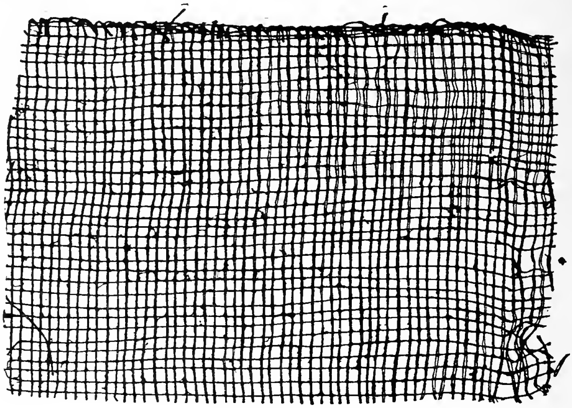
Warp yarn, 1-50s cotton. Filling, 1-80s cotton. Finished weight, 10 yards equal 7 ounces. The finished fabric carries about 12 per cent of sizing.

FINISHING.

After the fabric is taken from the loom, it is sent to the dyehouse. The first process is to boil it off, in order to rid it of all foreign matter pos-

sible; then it is dyed or bleached as required. After this process and after the fabric is dried, it is then immersed in size. Sizing the fabric is usually done in front of the drying cylinders. The goods pass from the size trough onto the drying cylinder, which practically completes the finishing process.

The goods are then doubled and put onto boards in the form of rolls, after which they are ready for the market.



Tarlatan.

Carding and Spinning Particulars.

The machinery required to make the counts of yarn of which tarlatan is made will be found in the second division of mills, as given in a previous article. The counts used for this class of goods differ slightly, but for this article we will consider the counts to be 1-50s for the warp yarn and 1-80s for the filling yarn. These yarns are made of American cotton of about 1 5-16-inch staple. This cotton is first mixed by hand, as large a quantity being mixed at one time as possible. In fact, two large mixings should be made so that one batch may be drying out while the other is being used. At this point the good sliver from all the machines up to the slubber is mixed in, it being collected at regular intervals from the machines. An eye should be kept on this waste by the one in charge to see that too much waste is not being made at any one machine and also to see that it is broken up into short lengths before being put into the mixings. Long lengths of sliver waste are apt to wind around the various rotating parts of the opener and cause a "bung up," which requires time to remove and also is apt to cause a fire.

If trunking is used to connect the opener to the breaker picker, be sure that no scraps of iron or other metal are around where they can work into the cotton, as this is also apt to cause a fire by coming in contact with the metallic parts of the machine and striking a spark, which ignites the other cotton very quickly and often causes a fire on account of the currents of air which fan it into a flame. Keep the hopper full of cotton for reasons previously given. The

SPEED OF THE BEATER

(two-bladed rigid type) of the opener is 1,500 revolutions per minute; the total weight of lap at the front is 40 pounds. These are doubled four times at the intermediate picker. The beater of this machine may be either of a rigid type or a pin beater. If of a rigid type it makes 1,400 revolutions per minute; if a pin beater, 1,450 revolutions per minute. The total weight

of lap at the front of this machine is 38 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. At this machine the cut-roving waste is mixed in with the raw stock in the proportion of one lap of cut waste to three laps of raw stock. The cut roving is first put through a process to take out the twist and then run through a picker to form it into a lap. The beater of this machine may be either a rigid or a pin type. If the former, its speed should be 1,450 revolutions per minute; if the latter, 1,500 revolutions per minute. The

TOTAL WEIGHT OF LAP

at the front of this machine should be 38 pounds or a 14½-ounce lap. At this machine all laps are weighed, and if they vary one-half pound from the standard weight they should be put up at the back and run over again. Always keep a supply of laps ahead in case of breakdowns, etc. The laps are then put up at the cards. The speed of the licker-in should be about 325 revolutions per minute; flats should make one complete revolution every 55 minutes. The card clothing should be 110s for cylinder and 120s for doffer and flats. Use a large doffer (either 26 or 27 inch diameter). Strip cards three times a day and see that they are ground all over once a month a whole day (twice a month grinding half a day is better).

ALWAYS GRIND LIGHTLY.

The card clothing should be looked after at intervals to see that it is not faced or hooked. Before grinding, all jams should be taken and flats should be kept free from cotton embedded in the wire fillet. After grinding, the parts should be set in proper relation to each other. The sliver at the front for the class of goods under description should weigh 65 grains per yard and the production should be about 700 pounds per week of 60 hours. The cotton should be run through three processes of drawing frames. It will be found

A GREAT ADVANTAGE

to run metallic top rolls for this grade of goods. The weight of the sliver at the finisher drawing should be about 65 grains, the doublings at each process of drawing being 6 into 1. The hank roving at the slubber should be about 55. The slubber roving for both the warp and filling roving should be put through three processes of fly frames, the hank roving being as follows: For warp, first 1.50 hank; second, 3.50 hank; jack, 10 hank; for filling yarn, first, 1.50; second, 4 hank; jack, 16 hank.

The roving for warp yarn should be taken to the ring spinning room and spun into 50s count on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6 inches; revolutions per minute of spindle, 10,000. The yarn is then spooled and warped and several warps put up at the slasher and the required number of ends run onto a beam at the front. The filling yarn is spun into 80s on a frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1¼ inches; length of traverse, 5 inches; revolutions per minute of spindle, 7,400.

Dyeing Particulars.

Tarlatans are dyed on the jig machine, or the color is boiled up in the starching process with the starch. The dyed colors, being faster, are mostly used. The following color is an example of a starched dyeing:

ORANGE.

One gallon of water; 6 ounces dextrine; 2 ounces tetrazo orange CR. Mix cold. Boil for 30 minutes. Pass the pieces through a starch mangle, and dry on tenter frame. All one-dip colors can be dyed after this formula and any shade produced by varying the amount of color.

RED.

Three per cent tetrazo red B.; 20 per cent Glauber's; 2 per cent sal soda.

PINK.

Four ounces benzo fast pink 2 BL.; 10 per cent Glauber's; 1 per cent sal soda.

LEMON YELLOW.

One-half per cent chrysophenine; 10 per cent Glauber's; 1 per cent sal soda.

GREEN.

Three per cent brilliant benzo green B.; 20 per cent Glauber's; 2 per cent sal soda.

WINE.

Two per cent diamine Bordeaux B.; 20 per cent Glauber's; 2 per cent sal soda.

SCARLET.

Two per cent diamine scarlet B.; 25 per cent Glauber's; 2 per cent sal soda.

LIGHT BROWN.

One-half per cent diamine catechine G.; ½ per cent diamine brown B.; 20 per cent Glauber's; 2 per cent sal soda.

SLATE.

One per cent diamine black BH.; 20 per cent Glauber's; 2 per cent sal soda.

SKY BLUE.

One per cent diamine sky blue FF.; 20 per cent Glauber's; 2 per cent sal soda.

NAVY BLUE.

Three per cent diamine blue RW.; 20 per cent Glauber's; 2 per cent sal soda.

BLACK.

Five per cent diamine jet black OO.; 20 per cent Glauber's; 2 per cent sal soda.

MAUVE.

One-half per cent diamine violet N.; 20 per cent Glauber's; 2 per cent sal soda.

GRAY.

One per cent diamine gray G.; 20 per cent Glauber's; 2 per cent sal soda.

ROSE.

One-half per cent diamine rose BD.; 15 per cent Glauber's; 1 per cent sal soda. The pieces are starched and dried on a tenter frame.

BROCATELLE

Brocatelle is a coarse brocaded or figured fabric of cotton and wool or silk and linen or cotton, used for tapestry and upholstery and sometimes for dresses. The brocatelle used for dresses is much finer and necessarily lighter in weight than the fabric used for upholstery purposes.

We will here consider the fabrics used for upholstery purposes only. This may be classed as a double cloth fabric, with two warps and two fillings, a face warp and weft and a back warp and weft. These warps and fillings, however, interweave with one another, thereby binding together the two sets of warp and filling threads, with this peculiarity, that the face warp threads do not show on the back of the fabric nor does the back filling show on the face of the fabric, while; on the contrary, the face filling shows on the back and the back warp threads show on the face.

The face warp threads give body to and also form the ornamental feature of the fabric, which is the raised or brocaded figure in the cloth.

These threads, when not forming the figure, lie buried between the face and back filling picks. The figure thus formed is usually of an eight-harness sateen weave, the ends floating over seven back filling picks and under one, while the back filling is used principally to give weight to the fabric and accentuate the raised figure.

Brocatelle, as already mentioned, is made with silk and wool, linen or cotton; the face is of silk, while the back has wool, linen or cotton, depending on the quality of fabric desired, as does also the quality of silk used in the fabric.

The yarns in all instances are

DYED BEFORE WEAVING.

The colors and number used depend upon the prevailing fashion. Some brocatelles are made up of several colors on the face of the goods, while again others have but two—the figure and ground colors. The figure color is usually darker than the ground. For example, a dark olive may be used for

figure color, that is, the face warp threads, while the ground color, face filling picks, may be a light salmon. The back warp is usually the same as the face filling, while the back fillin usually blends off to a lighter shade of olive. The object is to have the colors blend well together and at the same time form a harmonious contrast.

190 ends per inch in reed; reeded 8 ends 50-2 silk and 2 ends 2-110s cotton in one dent; 19 x 10 dent reed.

Ends per inch finished 200; finished width of fabric, 49.4 inches.

Filling: 116 picks per inch; 58, 21s silk salmon; 58, 28s linen light olive; total 116.

Linen 300 yards per pound; 10s cotton.

Fig. 1.

The ornamental features of brocatelles are elaborate, conventionalized floral figures which cover the greater portion of the surface of the fabric about 75 per cent. The figures are bold and rich, repeating about 4½ times across the width of the fabric. Fig. 1 gives an idea of the character of design used. This is about one-half the size it would be in the fabric.

THE CONSTRUCTION

is as follows;

7,904 ends 50-2 silk face warp.
1,976 ends 2-110s cotton back warp.
16 ends 4-20s white cotton selvage.

9,896 ends in warp.

Dressed, 4 ends olive 50-2 silk; 1 end salmon 2-110s cotton; total, 5 ends per warp pattern.

Filling arrangement: 1 pick 21s silk face; 1 pick 28s linen back; total, 2 picks, repeat.

Weight per yard of finished fabric 14.83 ounces.

Weight of various yarns used:

6.04 ounces face warp.
2.60 ounces face filling.
.70 ounce back warp.
5.46 ounces back filling.
.03 ounce selvage.

14.83 ounces.

LOOM REQUIRED.

Brocatelle requires a heavy jacquard loom. The patterns require from 400 to 1,200 ends and over, in order to repeat. Consequently, a machine that can operate the required number of ends is essential for the production of these fabrics. When a great number

of ends are required for the repeat of the pattern, two machines are combined; for example 2-600 machines will operate a 1,200 end pattern, but usually a French or fine index machine is used that will operate the required number of ends.

The pattern to be woven is first stamped on cards by means of a card cutting machine. This machine consists of a punch box, containing 13 punches; if a 600 machine, 25; if a 1,200 machine, 24 for cutting the smaller holes and one for the peg holes. These cards, when placed on the jacquard machine over the loom bear a direct relation to the warp threads, raising and dropping them according to the pattern. The warp threads in the drawing in are kept separate from each other; that is, the face warp threads are drawn through certain mails, as likewise are the back warp threads, although both sets of threads are represented on the one card.

FINISHING.

These fabrics require no finishing. They are smoothed and folded and are then ready for the upholsterer.

Carding and Spinning Particulars.

The mills which make the cotton yarns for brocatelle will be found in the second and sometimes the first division of mills, as given in a previous lesson. Brocatelle is a fabric made up of many different fibres, but the fabric under description is composed of silk and cotton, the back warp and selvage being composed of cotton yarns. It is these yarns that we will describe. The cotton back warp yarns are 2-110 cotton yarns, while the selvage is composed of 4-20s cotton yarns. The cotton used for the back warp of this count would be of a good American cotton of about 1 9-16-inch staple. This yarn should be put through a bale breaker and carried to the bins by means of a blower and trunking. This will insure the cotton at this point being dry, and in a more "picked out" state than when hand mixing is done. The cotton is mixed at the bale breaker in the usual manner, each bale being first stapled to make sure that the cotton is all up to standard.

COTTON MUST BE DRY.

If the mixing is done by hand it should be allowed to stand as long as possible before using, so that it will be thoroughly dry. Too much care cannot be taken at this point, as all carders know what trouble damp cotton makes. The good sliver waste from the machines up to the slubber is mixed in at this point, care being taken to see that only the cotton of the same grade and length of staple is thrown into the bin. This waste should not be put all in one place, but should be distributed all over the top and front or back of the mixing. The cotton is next run through an opener and

THREE PROCESSES OF PICKING.

At the opener the hopper should be kept well filled so as to feed the breaker picker an even sheet. The breaker picker beater is generally of the rigid type, either two or three blades being used.

If two blades are used, the speed should be about 1,500 revolutions per minute; if three blades, the speed should be proportionately slower. The total weight of the lap at the front is 37½ pounds or a 14-ounce lap. These laps are doubled four times at the intermediate. This picker is generally provided with a two-bladed beater, the speed of which for this class of cotton should not exceed 1,450 revolutions per minute. Some overseers

PREFER A PIN BEATER

at the machine and a rigid beater at the finisher and some just the reverse. If a pin beater is used, the fan does not have to be run at such a high rate of speed, as this beater creates considerable draught itself. The total weight of the lap at this picker is 36 pounds or a 13-ounce lap. These are put up at the finisher picker and doubled 4 into 1. The speed of this beater, two-bladed rigid type, is 1,400 revolutions per minute. The total weight of the lap is 35 pounds or a 12½-ounce lap. The cotton at this picker receives 42 beats per minute. The laps are put up at the card. The

licker-in speed should be about 350 revolutions per minute. The top flats make one complete revolution in 40 minutes. The cards should be ground and set once a month, stripped three times a day and cleaned and oiled twice a day; keep the front of the cards always clean from fly, etc. Collect flat strips at regular intervals, not too long apart, so that they will fall over the doffer and not get into the good work. The sliver at the front should weigh 60 grains per yard, and the production should be 550 pounds per week of 60 hours. This sliver is put through

THREE PROCESSES OF DRAWING.

The top rolls used may be either metallic or leather top rolls. These should be looked out for at all times, but especially so in hot weather to see that they are in perfect condition. Keep sweaty hands off of the varnish on the rolls. Varnish rolls frequently. A small piece of borax in the mixture will help harden the varnish. The weight of the sliver at the finisher drawing is 60 grains per yard. When the weight is kept at the drawings, they should be sized at least three times a day. This is then put through the slubber and made into .55 hank The roving is then put through three processes of fly frames, the hank roving at each process being as follows: First, 2.25; second, 6.50, and jack, 18.50. The roving is next spun into 110s on a frame having the following particulars: Diameter of ring, 1⅜ inches; length of traverse, 5 inches; speed of spindle, 9,400 revolutions per minute. This is then spooled, and twisted into 2-ply yarn and then run on a warper and through a slasher.

COTTON USED FOR SELVAGE.

The cotton to make the selvage yarn is 1⅛-inch staple. At the pickers the changes from the above are as follows: Speed of beater, breaker, 1,500 revolutions per minute; intermediate 1,450 revolutions per minute and finisher, 1,450 revolutions per minute.

The weights of the laps are as follows: Breaker, 40 pounds or a 16-ounce lap; intermediate, 37 pounds or a 12-ounce lap; finisher, 35 pounds or a 12½-ounce lap. At the cards note the following changes from the back warp yarn: Speed of top flats, 1 revolution every 50 minutes; weight of sliver, 65 grains per yard; production per week of 60 hours, 750 pounds.

Draft of cards should not be over 100. At the finisher drawing the weight of sliver at the finisher is 70 grains per yard. It is

AN ADVANTAGE

to use metallic top rolls on this stock at the drawing frame. Slubber roving should be .55 hank. There should be two processes of fly frames, the hank roving at each process being as follows: First intermediate, 1.75 hank; second, 5 hank. The roving is then taken to the spinning room and spun into 20s yarn on a frame, the particulars of which have been given before. The yarn is then spooled and twisted into 4-ply 20s.

Dyeing Particulars.

The colors are dyed on the silk, wool, or cotton, in the yarn. The colors used depend on the prevailing fashion.

The following wool colors are dyed in the acid bath of 20 per cent Glauber's salt and 3 per cent sulphuric acid.

For 100 pounds wool yarn:

LIGHT SLATE.

Four ounces patent blue B.; ¼ ounce orange II.

OLIVE BROWN.

One per cent orange II.; ½ ounce lanafuchsine SB.; 4 ounces fast yellow S.; 1 ounce indigo blue N.

LIGHT BROWN.

Two per cent orange II.; 1½ per cent fast yellow extra; 4 ounces azo crimson L.; 6 ounces fast green B.

OLIVE GREEN.

One and three-quarters per cent indigo blue N.; 1 per cent tropaeoline OO.

GREEN.

Two and one-half per cent indigo blue N.; ½ per cent fast yellow S.; 1½ tropaeoline OO.

BLACK.

Five per cent palatine black 4 B.

VIOLET.

Two per cent acid violet 4 BN.

SCARLET.

Two per cent palatine scarlet 4 R.

SALMON.

One and one-half ounces rhodamine 5 G.; 20 grains eosine yellowish.

ROSE.

Five per cent rhodamine G.

LAVENDER.

One ounce acid violet 4 BN.; 30 grains orange II.; 100 grains fast acid violet 10 B.

SILK COLORS.

Silk yarn is dyed in the soap bath with the addition of acetic acid.

SALMON.

One ounce rhodamine 5 G.

LIGHT LAVENDER.

One-quarter acid violet 4 BN.; 100 grains rhodamine G.

OLIVE GREEN.

One per cent fast green B.; 1 per cent fast yellow Ex.; 4 ounces orange II.

ROSE.

One per cent rhodamine 5 G.

NAVY BLUE.

Two per cent indigo blue N.; 4 ounces acid violet 2 BN.

RED.

One per cent fast red R.

LIGHT GREEN.

One per cent acid Victoria green SN.

LIGHT YELLOW.

Four ounces tartarzine S.

COTTON COLORS.

Following are the dyeing particulars for cotton colors:

BLUE.

Four per cent brilliant benzo blue 6 B.; 20 per cent Glauber's; 2 per cent sal soda.

LIGHT BROWN.

Two per cent diamine brown B.; 1 per cent diamine fast yellow B.; 20 per cent Glauber's; 2 per cent sal soda.

OLIVE BROWN.

Three per cent chloramine yellow M.; ½ per cent benzo dark green B.; ½ per cent benzo brown B.

TAN.

One-half per cent benzo fast orange S.; 2 per cent chrysophenine; 2 ounces benzo fast black.

GREEN.

Eight per cent immedial green GG.; 8 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt.

NAVY BLUE.

Ten per cent immedial indone 3 B.; 10 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's salt.

OLIVE.

Five per cent pyrogene olive G.; 5 per cent sodium sulphide; 2 per cent soda ash; 20 per cent Glauber's salt.

RED.

Five per cent benzo fast red 4 BS.; 30 per cent Glauber's; 2 per cent sal soda.

TERRY PILE FABRICS

Terry is a fabric in which the distinguishing effect is small loops of warp yarn, uncut pile, projecting from one or both sides of the cloth, these loops being tied to the ground cloth in regular or irregular order as desired.

The terry principle of construction, which has been developed with the power loom, is used extensively in the manufacture of cotton terry toweling, known generally as Turkish toweling.

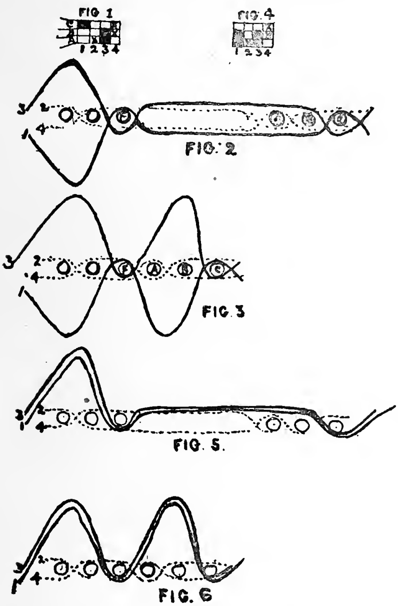
These towels are made in various sizes and grades from the cheap fabrics made almost entirely from waste yarns to those made of the best quality of cotton obtainable.

Terry pile is the simplest of the many types of warp pile goods, the effect being obtained without the use of wires.

Two warps are required: (a) the ground warp; (b) the pile warp.

The ground warp contains the selvage and ground ends, and is wound on the regular loom beam. This beam is heavily weighted in the loom. The pile warp is usually wound on a light beam and is allowed to let off the warp very easily.

The reason for the difference in tension on the warps is to allow the ground warp to remain tight and the



pile warp to go forward easily when it is required to loop.

Figs. 1, 2 and 3 will serve to illustrate the relation of a terry design to the cloth. Circles indicate picks; dotted lines, ground ends; continuous lines, pile ends. The numbered ends in each figure correspond.

Assuming F to represent the fell of the cloth, and the last pick of a repeat, Fig. 2 shows how the three succeeding picks A, B and C would appear when about to be driven to the fell of the cloth, and Fig. 3 a section of the cloth with the loop completed.

Figs. 4, 5 and 6 illustrate a design and sectional view of a terry cloth in which the pile is distributed on one side of the cloth only. Cloth of this type is used for furniture coverings and as a ground for embroidered effects.

Figured terry goods are made by combining colored yarns and terry effects, the terry being thrown on either side when the other is weaving a ground weave. The face and back are reversible.

LOOM REQUIRED.

In order to weave terry toweling a dobby loom differing from the ordinary loom is required. The principal point of difference is in its having mechanism to allow two (in three-pick terry) out of three picks to be beaten up to within a certain distance of the fell of the cloth, this distance depending upon the length of pile desired, then forcing these two picks along with every third pick, to the fell of the cloth.

The object of this is to allow the first two picks to fasten themselves into the pile ends, say one-half inch from the cloth, so that when the three picks are driven home together the pile ends will go along with them, making a loop slightly less than ¼ inch. At the same time the three picks will slide over the ground ends, these interlacing with the filling as in an ordinary cloth.

To accomplish the three-pick movement to form the loop one of two methods is adopted: (a) By rocking or oscillating reed which is held back or forced to the fell of the cloth as desired; (b) by a rocking whip roll and back roll terry motion. With this device the reed is held firm, the cloth being moved back toward the rear of the loom every third pick. A backward and forward movement, similar to that of the cloth, is imparted to the temples. The length of pile can be varied as desired, or the weave can be changed from terry to regular, or from regular to terry as required.

A loom for weaving terry towels, besides having mechanism for making the pile, contains mechanism for one or more of the following: (a) A box motion, for inserting different colors or kinds of filling; (b) a fringe motion

for making fringe at the end of each towel; (c) a motion for changing the weave from terry to regular construction or vice versa at the beginning and end of each towel. This is usually accomplished with a multiplier or repeater, or with a measuring device which automatically brings into play the pattern chain required.

Terry looms are usually heavily built and contain stands for as least two-warp beams.

FINISHING.

Some toweling is sold in the gray but most of it is bleached. First process: Boiled with 4 per cent caustic soda, boil for 12 hours, rinsed through water; second, again boiled with 4 per cent caustic soda, boil for 10 hours; third, passed through acid bath ½ degree Tw. sulphuric acid, rinsed with water; fourth, passed through chlorine water at ½ degree Tw. and laid down in bin until white; fifth, passed through acid bath of ½ degree Tw. sulphuric acid and rinsed well with water, dried and cut up into towels.

Carding and Spinning Particulars.

The yarns of which terry cloth are made vary from those made of waste stock to those made of long staple combed stock and it would be hard to describe one particular grade to make it cover all terry cloth. For this article we will suppose the average count of the yarn is 1-45s and will give the carding and spinning particulars for this count of yarn in both warp and filling yarns. We will also consider that the stock is carded.

THE MACHINERY USED

would be found in the equipment found in the second division of mills, as given in a previous article. The cotton would be brought from the cotton shed and sampled by the one in charge of this job; sometimes it is the overseer, sometimes the "super." and sometimes, in large mills, a cotton sampler is employed. All bales containing cotton not up to grade or length of staple should be placed at one side and not put into the mixing. The mixing should be as large as possible and may be done either by hand or, as is more generally the custom, by a bale breaker. One bale breaker is able to take care of a great many bales of cotton per week. The cotton is fed to the bale breaker from several bales of cotton, a little being taken from each. This is so that the cotton from all the bales will be intermixed, and in this manner a more even yarn is apt to result. After passing the bale breaker the cotton is conveyed to the mixing bins by an arrangement of endless lattices, which may be moved when it is desired to drop the cotton into another bin.

THE MIXING

should be allowed to stand as long as possible, especially if the mixing is done by hand. The cotton is then put through a bale breaker and three processes of picking. The hopper of the opener or feeder should always be kept more than half full so that the spiked lifting apron will always be carrying a load to the pin beater. In this manner an even amount of cotton is fed to the feed rolls of the breaker picker. The breaker picker is provided with either a two or three armed rigid type of beater. If two-bladed, the speed should not exceed 1,500 revolutions per minute for this grade and staple of cotton (1 5-16-inch peeler). The total weight of the lap at the front end of the breaker picker is 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. This picker may be provided either with a rigid or pin type of beater. They both have a great many favorites among the trade. The speed of a rigid two-bladed type should be about 1,450 revolutions per minute.

THE FAN SPEED

should be about 1,050 revolutions per minute. If a pin beater is used, the speed of the fan may be reduced. This is on account of the amount of draft that this beater creates itself. The total weight of the lap at the head end of this machine is 37 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled 4 into

1. What has been said of the beater at the intermediate picker applies here, except that the speed of a two-bladed rigid type should be 1,400 revolutions per minute. This gives the cotton passing through it about 42 beats or blows per inch. The cut roving is brought to the picker room and put through a special picker (to take out the twist) and then is run through a breaker picker to form it into a lap, and these laps are mixed with the raw stock at the finisher picker in the proportion of three laps raw stock to one lap cut waste. The total

WEIGHT OF THE LAP

at the front of the finisher picker should be about 35 pounds or a 12½-ounce lap. These laps are put up at the card; the draft of which should not exceed 110. The card clothing used should be for carding medium counts. This should be ground at least once a month all over, after which the card should be reset. Use gauges that are straight and not bent all out of shape. The cards should be stripped three times a day and kept clean. The speed of the licker-in should be about 300 revolutions per minute and the flats should make one complete revolution every 50 minutes. The weight of the sliver should be 65 grains per yard, with a production of 700 pounds for a week of 60 hours. Use as large a doffer as possible. This sliver is put up at the drawing frame and doubled 6 into 1. The sliver should be run through

THREE PROCESSES OF DRAWING.

Either metallic or leather-covered top rolls may be used to good advantage. Whichever top roll is used, it should be kept in the best of shape. The weight of the sliver at the front of the finisher drawing should be about 70 grains per yard. This is put up at the slubber and made into .55 hank roving. This is put through three processes of fly frames and made into 9 hank, the hank roving at each process being as follows: 1st, 1.25 hank; 2d, 3.50 hank, and fine, 9 hank. This is then taken to the ring spinning room and made into 45s warp yarn on a frame with the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6 inches; speed of spindles, 10,000 revolutions per minute; twist per inch, 30.19. This is then spooled and warped and the required number of warps put up at the slasher to give the required number of ends at the front warp. For making 45s filling yarn use a frame having the following particulars: Diameter of ring, 1¼ inches; length of traverse, 5½ inches; twist per inch, 25; speed of spindles, 8,500 revolutions per minute.

SATINE or SATEEN

Satine, or sateen, is a cotton fabric with a smooth, lustrous surface resembling satin. The latter is made of silk. The weaves for satins and satines are similar.

Satines, which are of two kinds, warp satines and filling satines, are made in a great variety of weights and qualities, and are used for many purposes.

The bulk of the goods are made on the filling satin principle and are used for linings, corset covers, dress goods, etc. These are usually woven grey and are bleached, or piece dyed in varying colors.

Warp satines are used for mattress and furniture coverings.

Stripe effects are made by using a warp containing different colors and a warp satine weave. Warp and filling satines are also printed, to a considerable extent, the smooth face lending itself very readily to this process.

COLORED EFFECTS

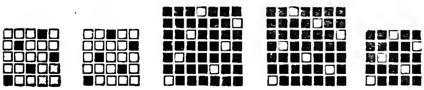
made in the loom are confined to stripes made when a warp satine weave is used, because the warp covers the filling almost entirely. In a filling satine the filling practically covers all the warp, and color inserted here would show in barry effect across the cloth.

The smooth, lustrous effect of satines is due in large measure to the weave used. Briefly stated, satine weaves are made on from five ends upward; they are complete on the same number of ends as picks; each

end and each pick interlaces only twice in each repeat; the interlacings do not support each other, at least one end or one pick separating them.

In filling satines each end is raised over one pick only in each repeat; warp satines, vice versa.

Figs. 1 and 2 illustrate the only two filling satine weaves that can be made on five ends. Both of these weaves are



1 2 3 4 5

used in the trade, some buyers preferring one to the other, according to the effect desired.

Figs. 3 and 4 show warp satine weaves on seven ends each.

The constructions of filling satine fabrics vary from about 64 to over 100 sley and 120 to 300 or more picks.

The following, which show results of the analyses of five different satine fabrics, will serve to show that the satine principle of construction is used in fabrics of widely differing qualities.

Sample No. 1. Colored warp satine stripe cloth for upholstery; 96 ends and 52 picks per inch; 7s cotton yarn for warp and 14s for filling. Woven with weave Fig. 5, a 5-end warp satine weave.

The filling in this particular sample is twisted harder than the warp.

Sample No. 2. A fine warp satine of good quality, made with a 7-end weave; 152 sley and 80 picks; 2-50s warp and 30s filling.

Samples 1 and 2, as well as almost all warp satines, on account of the large proportion of warp on the face, would be woven face down in the loom.

Sample No. 3. A filling satine of fair quality; 72 sley and 150 picks; 45s warp and 70s filling. Weave Fig. 1.

Sample No. 4. 96 sley and 280 picks; 45s warp and 97s filling. Weave Fig. 1.

Sample No. 5. 104 sley and 210 picks; 60s warp and 75s filling. Weave Samples 4 and 5 are of good quality.

Satines, whether warp or filling, are usually woven on single box cam looms of heavier build than plain sheeting looms. The selvages are actuated by a selvage motion. If woven on dobby looms, the selvage motion is dispensed with.

One warp only is required. The ends are drawn through the harnesses in straight order.

In practice it has been found advisable, when weaving heavily picked satines, to use a reed that is no deeper than is necessary. For warp satine, on account of the large number of ends and comparatively few picks per inch, deeper reeds are used, so that the wires will give, to some extent, for knots.

FINISHING SATINES.

Satine tickings are sheared and then calendered with hot steam rollers, the steaming being done in front of the machines; the appearance is improved by gas singeing. A method of finishing ordinary dyed yarn satines is to first saturate them with a mixture of corn or potato starch, China clay or baryta and tallow. To this is added soap or oleine, with wax and glue size. They are then mangled, dried, damped, calendered, folded and pressed.

There are many satines which are made from grey yarn and then finished as desired. This method of manufacture has developed extensively during recent years and is much more economical than was formerly noted where bleached and dyed yarns were used. Many of the so-called galateas are nothing more or less than a rather coarse satine, which has been woven with grey yarns then bleached and afterward printed with various striped patterns.

For printed or dyed satines, starch with a small portion of soda crystals for a stiff finish, and soluble oil with soda for a soft finish are used.

Carding and Spinning Particulars.

Satines are made up of various counts of yarns, the different samples analyzed being only a few of the various grades made, but they illustrate

the various grades very well. For the carding and spinning particulars of a satine, sample No. 5 will be taken as an example. This is made up of combed yarns of 60s for warp and 75s for filling. The cotton used would be Egyptian or peeler of 1⅝-inch staple. This grade of satine is made in either the second or third division of mills, as given in a previous lesson. Of course,

THE EQUIPMENT

will have to include combers. The cotton is first sampled and then mixed in a manner that has been described in previous lessons. It is better to use a bale breaker, but cotton may be mixed by hand. If mixed by hand, let the mixing stand a little longer to dry and open out as the cotton is compressed very tightly in the bales. These Egyptian bales weigh considerably more than the American bales.

The good waste from the machines up to the slubber should be mixed in at the mixing bin. The cotton is next put through an opener and three processes of picking. The hopper of the opener should always be kept

OVER HALF FULL,

so that an even amount of cotton will be fed to the breaker picker. The breaker picker is provided with either a two or three bladed beater of a rigid type. If the former, the speed should be about 1,350 revolutions per minute. The total weight of the lap at the front should be 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. The beater of this picker is either a two or three bladed rigid or a bin beater. If the former, the speed of it should be 1,250 revolutions per minute. If a pin beater is used, the fan speed should be reduced for reasons given in a previous article. The total weight of the lap at the front should be 36 pounds or a 12-ounce lap. These laps are doubled 4 into 1 at the finisher picker. At this picker the cut-roving waste, which has previously been put through a roving picker, to take out the twist, and a breaker to form the fluffy mass into a lap, is mixed in in the proportion of three laps of raw stock to one lap of cut-roving waste. If the equipment of machinery does not include a roving picker, the cut roving is mixed in at the mixing bin, care being taken to spread it over the entire mixing. The speed of the finisher picker beater of a rigid two-bladed type is 1,200 revolutions per minute. The total weight of the lap at the front is 35 pounds or a 12½-ounce lap. These laps are put up at the card. The wire fillet used should be 120s for cylinder and 130s for doffer and flats. Use a 26 or 27 inch diameter doffer. The speed of the cylinder should be 160 revolutions per minute; licker-in, 300 revolutions per minute. Top flats should make one complete revolution in 35 minutes. The draft of the card on this stock should not be less than 125.

THE CARDS

should be stripped three times a day and ground at least once a month, at which time the various settings should be gone over. Set doffer to cylinder with a 5 gauge. The sliver at the front weighs 55 grains per yard and the production is about 475 pounds per week of 60 hours. This sliver is taken to the sliver lap machine and doubled 14 into 1 for an 8¾-inch lap (wide) or 20 into 1 for a 10½-inch lap. These laps are generally put through a ribbon lap machine, the weight of them being 330 grains per yard for an 8¾-inch lap or 380 grains for a 10½-inch lap. The laps are doubled 6 into 1 at the ribbon lap, the weight at the front being 265 for an 8¾-inch lap and 320 grains for a 10½-inch lap. These laps are put up at the comber and doubled either 6 or 8 into 1, according to whether the comber is a six or eight head comber.

THE EIGHT-HEAD COMBER

is the one that is being put in nowadays, very few of the six-head being sold. A new development which has been noted the last few years is the use of single head combers. These are practically entirely produced in foreign countries, their method of operation being somewhat different than the old style machine, and for various reasons they are considered more satisfactory than the six or eight head

comber. Probably there are a greater number of such machines being installed in new mills than there are of the older style machine. The speed of the comber should be at least 90 nips per minute, and may run up as high as 105. The percentage taken out should be about 20. The weight of the sliver at the front is 40 grains per yard. The combed sliver is next put through two processes of drawing, the speed of the front roll being 400 revolutions per minute. Either metallic or leather-covered top rolls may be used, generally the latter. These should be varnished frequently and those that are damaged, fluted, loose or not true should not be run. If the latter, they may be buffed, as may also the leather rolls at the comber. See that the stop motions are all in working order, and that the traverse motion is set and working so that the whole surface of the leather rolls is used.

THE SETTING

or spread of the rolls for this stock should be 1⅞ inches front roll to second; 1½ inches second roll to third, and 1⅝ or 1¾ inches third to back roll, according to bulk of cotton being fed. The doublings at the drawing frames are 6 into 1. The weight of the sliver at the front is 60 grains per yard. This sliver is put through the slubber and made into .70 hank roving, after which it is put through three processes of fly frames and made into the following hank roving at each frame. First intermediate, 1.75; second intermediate, 4.50; and fine, 15; at the fine frame the lays per inch on the bobbin being 48.

The standard for twist for this kind of cotton is 1.2 multiplied by the square root of the count. For example, the count or hank is 15. The square root of 15 is 3.87, which multiplied by 12, equals 4.64. If the standard for twist on this frame was 94.9, the twist gear used would be 20. The method by which this is found is by dividing the constant for twist by the standard for twist (American frames). Look out for the leather top rolls, traverse and clearers to see that each is performing its duty properly. Of course, the speed of the rolls is very important, the general method being to gain 1-16 of an inch over stock at each roll. The production should be about 33 hank per spindle per week of 60 hours. The 15-hank roving is taken to the ring spinning room and made into 60s warp yarn on a frame having a gauge of 2¾ inches; ring diameter of 1½ inches, and length of traverse, 6 inches; with spindle speed of 10,000 revolutions per minute. The yarn is then put through a spooler and warper and then a slasher. The filling yarn is made from the 15-hank roving on a frame having a 1¼-inch diameter ring, 5-inch traverse and spindle speed of 7,400 revolutions per minute. The roving for the filling yarn may be taken to the mule room, but for this class of goods is generally taken to the ring frame spinning room.

Dyeing and Finishing Particulars.

PINK.

One-half per cent Erika pink; 20 per cent Glauber's; 2 per cent sal soda.

HELIOTROPE.

One per cent tetrazo chlorine lilac B.; 20 per cent Glauber's; 2 per cent sal soda.

NAVY BLUE.

Three per cent tetrazo blue Rx.; 25 per cent Glauber's; 2 per cent sal soda.

GRAY.

One-half per cent thio gray B.; 10 per cent Glauber's; 2 per cent sal soda.

LIGHT SLATE.

One-half per cent direct black S.; 20 per cent Glauber's; 2 per cent sal soda.

PEACOCK BLUE.

Two per cent Eboli blue B.; 20 per cent Glauber's; 2 per cent sal soda.

RED.

Three per cent direct red B.; 20 per cent Glauber's; 2 per cent sal soda.

SLATE.

Two per cent katigen black SW.; 2 per cent sodium sulphide; 20 per cent Glauber's; 2 per cent soda ash.

ROYAL BLUE.

Three per cent brilliant benzo blue 6B.; ¼ per cent benzo fast violet R.; 25 per cent Glauber's; 2 per cent sal soda.

TAN BROWN.

Three per cent benzo fast orange S.; 2 per cent chrysophenine; ½ per cent benzo fast black; 30 per cent Glauber's; 2 per cent sal soda.

SKY BLUE.

One and three-quarters per cent diamine sky blue FF.; 25 per cent Glauber's; 2 per cent sal soda.

BROWN.

Three per cent diamine brown B.; 30 per cent Glauber's; 2 per cent sal soda.

WINE.

Three per cent diamine Bordeaux B.; 30 per cent Glauber's; 2 per cent sal soda.

SCARLET.

Two and one-half per cent diamine scarlet B.; 25 per cent Glauber's; 2 per cent sal soda.

Satines are finished by passing through a calender machine to give a fine luster finish and are sometimes placed on a beetle machine and beetled for two hours. They are starched first with a very light starch, and a little white soluble softening, to give a soft, smooth feel.

MUSLIN—BUTCHER'S MUSLIN

Muslin is commercially understood to mean a soft cotton fabric, used for various purposes, but principally for dress goods, underwear, sheetings, etc. Some muslins are named from their place of production, as Asoreem, Dacca, India, Madras and Swiss, while some are named from the use to which they are chiefly put, as butcher's muslin, which derives its name from the fact that it is chiefly used by grocery men and butchers in the form of aprons and coverings. It is a strong bleached fabric, well suited for the purposes. Muslin is so called from Mosul, a city on the banks of the Tigris, where was once the chief seat of its manufacture, but today large quantities are manufactured in the United States.

The quality of muslin is as varied as are the names by which it is known. Butcher's muslin is but a substitute for butcher's linen. Cotton is cheaper and almost as durable, and because of this it has forced itself to the front. Butcher's muslin is easily distinguished from the others by its coarseness. However, considerable quantities are used for summer outing dresses, for which purposes the bleached fabric only is used. The unbleached is used principally for sheetings and sometimes for pillow cases. The unbleached fabric is preferred where durability is the chief object. It is a common fact that unbleached fabrics will wear better than bleached.

Muslin is used only in the bleached or unbleached state. The fabric is seldom dyed.

As previously mentioned, there are various kinds of muslin; in fact, anything in the line of soft cotton fabrics may be termed muslin. The name by which a particular kind is commonly known may vary likewise in quality, as, for example, there are several qualities of butcher's muslin, as an analysis would prove.

Analysis of a fair grade of butcher's muslin, which retails at 15 cents per yard: width in reed, 37½ inches; finished width, 36 inches; ends in warp. 1,900: 1.844 in body; 28 ends each side equal 56, selvage; total, 1,900; 900 x 2 reed; 52 ends per inch finished; warp, 1-12s cotton; take-up during weaving, 8 per cent; filling, 40 picks per inch in loom; 38 picks per inch finished; 1-15s cotton; weight per yard in the gray, 5 ounces.

LOOM REQUIRED.

Muslin is a plain woven fabric; consequently any loom may be used in the weaving of these goods. The cost of production is, of course, reduced in proportion to the speed of the loom and the number of looms a weaver can take care of. The least expense would be incurred by using an automatic loom.

The warp should be sized so as to withstand the chaf-

ing during weaving. As a rule, all single yarns are sized before they are beamed. The warp is drawn in on 4 harnesses. Fig. 1 shows design.

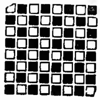


Fig. 1.

FINISHING.

The unbleached receives little or no finishing. After it comes from the loom, it is simply boiled off, dried, made up into rolls and then shipped.

When the fabric is to be bleached, it is first boiled off, then subjected to the bleaching chemicals, after which it is sometimes subjected to a very light sizing, composed of corn, or wheat, glycerine, bees' or Japan wax, after which it is run through a rotary press, then made up into rolls or folded and shipped.

Carding and Spinning Particulars.

The yarns of which butcher's muslin is made are of a low count and are made in mills of the first division. The grade of cloth is sometimes made up of raw stock and a certain percentage of waste. The raw stock used very rarely exceeds $\frac{7}{8}$ inch in staple and is of a low-grade American cotton. While the same care is not taken of this class cotton at the different processes for this cloth, still care should be taken to see that each machine is working properly to its best advantage for production. In this class of goods production is

THE FIRST CONSIDERATION

and quality the second. This does not mean that quality should be sacrificed wholly for production, but that the machines should be driven to a greater extent and the best possible work turned off of them under these conditions. For example, at the card the top flats should not be set or driven at the same speed as when finer goods are made, and so it is with all the machines. The cotton mixings should always be as large as possible and should be allowed to stand as long as possible before being used. This gives the cotton a chance to dry out. A better plan (if there is room enough) is to have two large mixings and use the cotton from one while the other is drying out. If cotton is very damp, the heat should be turned on to help dry it out. This is generally done at night or over Saturday and Sunday. It is at this point that the good waste from all the machines is mixed in, care being taken to see that the waste is spread as evenly as possible over the mixing. As the cotton is generally quite dirty, it is put through an opener and three processes of picking. The hopper of the opener should always be kept full of cotton. The opener is connected directly with the breaker picker and this machine is provided with either a two or three bladed rigid beater. If of a two-bladed type

THE SPEED

should be about 1,550 revolutions per minute. The total weight of the lap at the front should be about 40 pounds, or a 16-ounce lap. These laps are put up and doubled four into one at the intermediate picker. This beater is generally of a two or three bladed rigid type, and if the former its speed is 1,500 revolutions per minute. The laps at the front of this machine weigh 38 pounds total weight and 10 ounces per yard. The laps are put up at the finisher picker and doubled four into one. This machine is generally provided with a two-bladed rigid type of beater having a speed of about 1,500 revolutions per minute. The laps at the head end weigh 40 pounds or 14½ ounces to a yard. An allowance of 10 ounces either side of standard is made with this staple cotton. If the lap varies more than this, it should be run over again. These laps are put up at

THE CARD.

This should be set coarse and have No. 100 wire fillet on cylinder and top flat, the doffer fillet being No. 110 The draft of card should not exceed 100. Strip cards at least three times a day. The cards on this stock need more stripping than when long-stapled stock is used, because of the greater bulk passing through and also

on account of the short staple, which fills up the wire. The card sliver weighs 65 grains per yard and the production should be about 1,000 pounds per week of 60 hours. This is put through two processes of drawing frames. It is of great advantage to use metallic rolls on this class of goods. The speed of front rolls is 400 revolutions per minute. Keep rolls free from dirt and fly. The sliver is put through the slubber and made into .40 hank roving. This is put through two processes of fly frames, having the following hank roving: 1.30 at the first and 3.25 at second. The roving is then taken to the spinning room and made into 15s on the filling frame and 12s on the warp frame. Use a warp frame with 3-inch gauge, 2⅛-inch ring and 7-inch traverse, with a 16.45 twist per inch and spindles revolving at 9,000 revolutions per minute. This yarn is then spooled and wound on a warper. Enough beams are put up at the back of the slasher to give a beam with the required number of ends in front. To make 15s filling yarn use a frame having 2¾-inch gauge, 1½-inch diameter ring, 6½-inch traverse, 12.59 twist per inch and spindle speed of 6,900 revolutions per minute.

HENRIETTA CLOTH

Henrietta cloth is a light-weight fabric for women's wear, made in all colors from single worsted yarn, with silk mixture in the best qualities.

The cheaper qualities are made with cotton and worsted, the cotton yarn being for the warp, while the worsted is used for filling. Henriettas are made in various qualities; for example, the "all-worsted" from various grades of fine worsted yarn; the worsted and silk mixture from various grades of each; the "cotton and worsted" made up in various qualities of cotton and worsted yarn.

When the fabric is made with different qualities of yarn, that is, the warp differing from the filling in quality or kind, the cheaper quality or kind is in all instances used for warp. The reason for this is readily understood, when the character of the weave is taken into consideration. The weave for this fabric is a one-up, two-down twill, the weave repeating on three ends and three picks. Fig. 1 shows

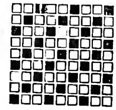


Fig. 1.

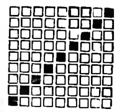


Fig. 2.

nine repeats of the weave; Fig. 2, drawing-in draft. This weave will show but one-third of the warp on the face of the fabric and two-thirds of the filling; the filling is usually of a slightly coarser count than the warp, especially when cotton warp is used, consequently the filling, to a certain extent, covers the warp yarn. The two factors, the weave, viz., $\frac{1}{2}$ twill and the coarser count of filling, give to the face of the fabric a much finer feel than the back. The feel or handle of henriettas is very important, consequently the above-mentioned particulars should be kept in view when constructing a fabric of this character, as its commercial value is largely influenced by the feel of the fabric.

PIECE-DYED.

The cloth is dyed after it is woven. Considerable quantities of cotton and worsted henriettas are bleached or finished in the gray; when the cotton and worsted fabric is to be dyed, the cotton yarn is prepared so as to take color in a worsted dye, otherwise two dyeing processes would be necessary—one for the cotton yarn and one for the worsted. The one-dip or union dye makes the cost of finishing but normal. Preparing the cotton yarn for the worsted dye is accomplished before the yarn is warped or beamed.

ANALYSIS.

Width of warp in reed, 38 inches.
Width of fabric finished, 35 inches.
Ends per inch in reed, 70.
Ends per inch finished, 76.
Reed, 35x2.
Ends in warp 2,620, plus 40, 20 ends each side selvage; total ends in warp, 2,660.
Warp yarn, 1-50s cotton.

FILLING.

1-40s worsted.
64 picks per inch in loom.
66 picks per inch finished.
Finished weight per yard, three ounces.

WEAVING.

Henriettas are usually woven on dobby looms, the speed of which is from 120 to 140 picks per minute; it is essential that the warp is well sized, adding about 15 per cent of weight to the yarn; wheat, flour, sago or potato starch may be used; in connection with this, a small quantity of chloride of magnesium should be added to give the yarn the necessary moisture and pliability.

FINISHING.

First process: After the fabric is woven, it is scoured, then bleached, dyed or left in the gray, as the case may be, after which the fabric is subjected to a very light singeing in order to slightly stiffen the cloth, after which it is pressed, then made up into rolls.

Carding and Spinning Particulars.

The yarns which make up henrietta cloth are made up of two fibres, worsted for the filling and cotton for the warp yarn. The count of the warp yarn is 1-50 and this count of yarn would be made up in mills of the second division, as given in a previous article. This equipment should include combers, as this yarn in most grades of the cloth under description is combed. The cotton is mixed in the usual method, which has been described several times. It is

OF GREAT ADVANTAGE

to use a bale breaker for this class of yarns. The cotton is put through three processes of picking, the breaker picker being combined with an opener. The breaker picker is provided with a three-bladed beater, the speed of which is 1,200 revolutions per minute. The lap at the front weighs 39 pounds to the lap or 16 ounces to the yard. These are doubled 4 into 1 at the intermediate picker. This picker has a pin beater, the speed of which is 1,300 revolutions per minute, the fan speed being reduced on account of the extra draft caused by the pin beater. The total

WEIGHT OF LAP

at the front end of this picker is 37 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. At this point the cut-roving waste is also mixed in in the proportion of 1 lap cut waste to 3 laps raw stock. This picker is generally provided with a two-bladed beater, the speed of which is 1,400 revolutions per minute. Keep the beater blades sharp and properly adjusted. This speed of the beater gives the cotton passing through the picker about 40 beats or blows to the inch. The total weight of lap at front is 35 pounds or a 12½-ounce lap. The lap for this class of work is allowed half a pound variation either side of standard weight; if more than this, it should be run over again, because, if put up at the card, it would have a tendency to make uneven work.

AT THE CARD

the following particulars should be observed: Draft of card not less than 110; wire fillet for cylinder, 120s; for doffer and top flats, 130s. Use large doffer. Strip three times a day. Grind all fillet once a month, leaving grinding rolls on all day. Grinding twice a month is better, leaving grinding rolls on half a day. The speed of the licker-in is 300 revolutions per minute; flats, 1 revolution in 35 minutes. The weight of sliver at front should be about 50 grains per yard; production, 550 pounds per week of 60 hours. This sliver is taken to sliver lap machines and doubled 14 into 1 for 8¾-inch lap or 20 into 1 for 10½-inch lap. The

SPREAD OF ROLLS

for this stock (peeler 1¼-inch staple) should be as follows: Front to middle, 1⅝ inches; middle to back, 1¾ inches. The weight per yard of lap at the front is 300 grains for 8¾-inch lap or

350 grains for a 10½-inch lap. These laps are put up at the ribbon lap machine and doubled 6 into 1. The weight per yard of lap at the front is 265 grains for 8¾-inch lap or 315 grains for 10½-inch lap. This gives a draft of about 7 for this machine. These laps are put up at the comber and doubled either 6 or 8 into 1, according to the number of heads on the comber. If 8 heads, the laps should be 10½ inches wide and set as follows: Cushion plate to half lap, 18 gauge; top combs to segment, 20 gauge. Feed at 5½, top comb set to 29 degrees angle; a double row of needles is used on top comb; 18 per cent waste should be taken out.

THE SPEED

should be 100 nips per minute; draft about 40; weight of sliver, 50 grains per yard. The setting of rolls in draw box should be as follows: Front to middle, 1⅜ inches; middle to back, 1⅝ inches. This sliver is put up at the drawing frames and doubled 6 into 1 and put through two processes, the speed of front roll at each process being 380 revolutions per minute, the spread of the rolls being as follows: Front to second, 1⅜ inches; second to third, 1⅝ inches; third to back, 1¾ inches. Use leather top rolls on this class of drawing and keep them well varnished and in perfect condition. The weight of sliver at the front of the finisher drawing is 65 grains per yard. This is put up at the slubber and made into .50 hank roving.

AT THE SLUBBER

the front rolls for this class of goods are sometimes varnished, but this is not often done, they being varnished when running on Sea Island stock. The slubber roving is put through three processes of fly frames, the hank roving at each process being as follows: First intermediate, 1.50; second intermediate, 3.50, and jack, 10 hank. Look out for the traverse motion and do not lay roving too close to make triangular roving. This roving is then spun into 50s yarn on a ring spinning warp frame with a 2¾-inch gauge of frame, 1½-inch diameter ring and a 6-inch traverse. The speed of the spindles is 10,000 revolutions per minute, the twist per inch, 31.81. This yarn is next put through a spooler, then a warper and from here to a slasher. A good-sized mixture for this class of goods is as follows: Water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds; white soap, 1½ pounds.

Dyeing Particulars.

This cloth is dyed with union colors, the wool and cotton being dyed in the same bath. The goods are entered into the dye-kettle; after the color has been boiled up with from 20 to 30 per cent of Glauber's salt, cool off with water to 120 degrees F. Run the goods for 20 minutes; heat to 200 degrees F. Run for 30 minutes. If wool is not dark enough, boil for some minutes more; when wool is only a shade too light, turn off steam and run for 30 minutes or until the cotton is colored to shade. If the goods are boiled too long the wool will be too dark and the cotton thin.

UNION BLACK.

5 per cent union black BF.; 25 per cent Glauber's salt; 5 per cent salt.

LIGHT BROWN.

1½ per cent diamine fast yellow B.; ½ per cent diamine orange B.; ½ per cent diamine brown M.; 6 ounces union black BF.; 30 per cent Glauber's; 2 per cent salt.

NAVY BLUE.

3 per cent diamine black BH.; 1 per cent union black BF.; 4 per cent naphthol blue black; ½ per cent formyl violet S 4 B.; 30 per cent Glauber's; 5 per cent salt.

RED.

5 per cent benzo fast red S 4B.; 30 per cent Glauber's; 5 per cent salt.

LIGHT TAN.

100 pounds goods: 1 ounce tetrazo orange G.; ¼ ounce union tetrazo black B.; ¼ ounce tetrazo Bordeaux G.; ⅛ ounce tetrazo brown R.; 20 per cent Glauber's salt.

SLATE.

1 per cent diamine black BH.; ¼ per cent diamine fast yellow B.; 20 per cent Glauber's.

PURPLE.

2 per cent diamine violet N.; ¼ per cent union black; 1 per cent formyl violet S 4 B.; 30 per cent Glauber's.

SCARLET.

3 per cent diamine scarlet B.; 30 per cent Glauber's salt; 5 per cent salt.

PEA GREEN.

½ per cent diamine green B.; 1 ounce diamine sky blue; 30 per cent Glauber's.

ROYAL BLUE.

3½ per cent diamine brilliant blue G.; ½ per cent diamine violet S 4 B.; 30 per cent Glauber's; 5 per cent salt.

DARK GREEN.

2½ per cent diamine black HW.; 2 per cent diamine green B.; 30 per cent Glauber's; 5 per cent salt.

RUBY.

3 per cent diamine fast red F.; ½ per cent diamine Bordeaux B.; 30 per cent Glauber's; 5 per cent salt.

CAMBRIC

Cotton cambric is a fabric woven with a plain weave, the distinguishing effect being a heavily glazed, smooth surface. The glossy effect is obtained in the finishing process. The goods are somewhat lighter in weight than French percale.

When finished white or in solid colors they are used very extensively

FOR LINING PURPOSES.

The name cambric, like many other names of dry goods, does not signify any special construction or quality of fabric, being made in both linen and cotton materials.

The name is said to have been originally given to a very fine, thin linen fabric made at Chambrey, or Cambrai, in the department of Nord, French Flanders.

Cambric is known in France as batiste, so called, it is said, from its inventor, a linen weaver named Baptiste, of Chambrey. One authority states that French cambric is the finest linen fabric made.

Cotton imitations of the original cambric are of the muslin type and are sometimes termed cambric-muslin.

The finer grades of cotton cambrics are made from hard twisted cotton yarns, and are of good quality.

LOOM REQUIRED.

Any of the light, single-box fast-running looms or automatics are suitable for weaving cambrics, the goods being woven white, then bleached or piece-dyed as required.

The finest grades, where mispicks tend to make second quality goods, are woven on the regular looms.

Little attention is paid to mispicks when weaving the lower qualities of goods, and these can be made most economically on the automatic looms.

ANALYSIS.

An analysis of a black cambric of only fair quality shows the following data: Finished width, 36 inches; finished weight, 4 yards per pound; ends per inch, finished, 70; picks per inch, finished, 54.

The average number of the yarns in the finished sample is 24, but on account of the starch, clay, or other filling substance used in the finishing process, the gray yarns would be finer than 24.

To obtain the fabric just mentioned, the following might be adopted, both as to construction and finish:

Width of warp in reed, 38¾ inches.
Warp yarns, 26s cotton.
Filling yarns, 28s cotton.
Eight double ends on each side for selvages.
Total ends, 2,536.
Seventy sley reed, 2 ends per dent.
Fifty-six picks per inch.
Weight, 4.3 yards per pound from loom.

The finished and unfinished weights do not bear a direct proportion to the average counts of yarns in each case

on account of the increase in length of the cloth during the process of finishing.

FINISHING.

After dyeing, open the goods out to the full width and run through a mangle containing the filling substance; then dry.

After drying, dampen in a damping machine and run through a calender.

For a fine white cambric the goods would be bleached, opened out to the full width, run through a starch mangle, containing a light starch or filling substance, the starch being blued to give the shade required, dried, dampened and run through a 5-bowl calender twice, the same side of the cloth being presented to the surface of the brass or steel roll each time.

Carding and Spinning Particulars.

The yarns of which cambric is made are spun in mills having the equipment of the first and second division of mills as given in a previous article. Cambric is made in mills or sets of mills where only this grade of cloth or perhaps two or three other styles of cloth of the same grade of fabric are made and after the proper gears hank roving are once found they are never changed. In fact, a machine or set of machines may run on this grade of goods its whole lifetime, the only changes made being in case of a breakdown, or parts and gears becoming worn out. Cambric is made from American cotton, the length of the staple used being from ⅞ to 1¼ inches. For this article we will consider the staple to be 1 inch in length and the count of the yarn to be as follows: 26s for warp and 28s for filling.

THE MIXING

is generally done by hand, and the mixings are always as large as possible. In some mills two large mixings are made so that one can be drying out while the other is being used. Better results are obtained by the latter method. The good sliver waste from machines up to the slubber, as well as the cut-roving, is mixed in at the mixing bin. The cotton is then put through an opener and either two or three processes of picking, three processes being the general method. The opener is either directly connected with the breaker picker or is connected by trunking; if by trunking, keep it clear, so as not to cause fire. The

SPEED OF THE BEATER,

which is of either a two or three bladed rigid type, is 1,500 revolutions per minute for the two-bladed, or 1,000 revolutions per minute for the three-bladed type. The total weight of the lap at the front of breaker picker is 40 pounds or a 16-ounce lap. These are doubled four into one at the intermediate picker. The speed of this beater, which is generally of a rigid two-bladed type, is 1,450 revolutions per minute, the total weight of lap at the front being 38 pounds or a 12-ounce lap. These laps are put up at the finisher picker and doubled four into one.

This picker is equipped with a two-bladed rigid style of beater, and makes 1,450 revolutions per minute, which gives the cotton passing through about 42 blows or beats per inch, the total weight of lap at front being 39 pounds or a 14½-ounce lap. The cotton is next put up at the card.

THE CARDS

on which cambric was formerly made are to some extent now used and are known as the top flat card. These are fast going out of date, so that the particulars given below refer to the so-called English card. The draft for this card, for these goods, should not exceed 90. The wire fillet used should be 100s for cylinder and 110s for doffer and top flats. The speed of the cylinder should be 160 revolutions per minute; licker-in, 400 revolutions per minute, and top flats should make one complete revolution in 50 minutes. Grind once a month. Strip three times a day and if running an extra heavy production, strip once more. Set top flats to cylinder to a 12-1000ths gauge and doffer to cylinder to a 7-1000ths gauge. Use large doffer. The

WEIGHT OF SLIVER

at the front of the card should be 65 grains per yard and the production

about 750 pounds for a week of 60 hours. The card sliver is next put through either two or three processes of drawing, generally three. The doublings are generally six into one. The speed of the front roll is 400 revolutions per minute. On this class of goods some overseers prefer the metallic top rolls. In calculating the production of a drawing frame with metallic top rolls, it is the general rule to allow one-third more than that figured for leather rolls. It is found, however, that this is too great, and if the allowance is cut down to ¼ or 25 per cent, it will be found about right. Keep metallic rolls clean and well oiled. In figuring

DRAFT OF FRAME

with metallic top rolls, add 7 per cent when draft does not exceed 3.75, and 9 per cent when draft is between 4.60 to 7. If leather top rolls are used, care should be taken to see that they are properly oiled and free from flutes; they should be level, without breaks in leather, and the leather cot should be tight and last should be varnished frequently. A good recipe for a cooked varnish is given below: One quart vinegar, seven ounces glue, two teaspoons gum tragacanth, borax, size of walnut, one teaspoon brown sugar. cook about an hour. Thicken with lampblack and Princess metallic. One that does not need cooking is as follows: Three ounces glue, one ounce acetic acid, one-half teaspoon brown sugar, one-half teaspoon oil origanum. Dissolve and add color; add one-half teaspoon of borax in hot weather. The bottom steel rolls should be set as follows: Front roll to second, 1⅛ inches; second to third, 1⅜ inches; third roll to back, 1⅝ inches. The weight of sliver at the front of the finisher drawing should be 70 grains per yard. This is put through the slubber and made into .40 hank roving. The

SLUBBER ROVING

is put through two processes of fly frames, the hank roving at each being as follows: First intermediate, 1.75, and second intermediate, 5; the setting of the bottom steel rolls at each process being 1 1-16 inches from front to middle and 1¼ inches from middle to back. The roving is taken to the ring spinning room and spun into 26s yarn on a warp frame having the following particulars: Gauge of frame, 2¾ inches; diameter of ring, 1¾ inches; twist per inch, 24.22; length of traverse, 6½; revolutions per minute of spindles, 9,200. The yarn is next spooled and then warped, after which it is put through a slasher. On this class of goods a heavy sizing is used. The roving is spun into 28s yarn on a filling frame with a 2¾-inch gauge of frame; 1⅝-inch diameter ring; 6-inch traverse; 17.20 twist per inch; revolutions per minute of spindle, 7,300. This yarn is then taken to the steam chest or put through some other process which prepares it for weaving.

Dyeing Particulars.

Cambrics are dyed in the jig machine or the continuous machine. The fancy colors are dyed on the jig. After dyeing, the pieces are starched with a light starch and calendered through a heavy calender.

BLACKS.

One-dip salt black, 6 per cent oxydiamine black S A T.; 30 per cent Glauber's; 3 per cent sal soda.

SULPHUR BLACK.

Ten per cent immedial black N N.; 10 per cent sodium sulphide; 5 per cent soda ash; 20 per cent Glauber's.

BOTTLE GREEN.

Ten per cent thionol dark green; 2 per cent thionol yellow; 15 per cent sulphide sodium; 3 per cent soda ash; 30 per cent common salt.

PEA GREEN.

Two per cent immedial green B B.; 2 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

NAVY BLUE.

Three per cent direct indigo blue B E M.; 15 per cent salt; 2½ per cent frankhansine.

DARK SLATE.

One per cent Pluto black S S.; 40 per cent Glauber's salt; 2 per cent soda ash.

BROWN.

Three per cent tetranil brown O.; 30 per cent Glauber's; 3 per cent soda ash.

LIGHT BROWN.

One-half per cent tetrazo yellow M.; 1 per cent tetranil brown O.; 30 per cent Glauber's; 3 per cent soda ash.

OLD GOLD.

Three per cent diamine fast yellow B.; ½ per cent diamine bronze G.; 30 per cent Glauber's; 3 per cent soda ash.

SLATE.

Two per cent diamine black B H.; 2 ounces diamine yellow B.; 30 per cent Glauber's; 3 per cent soda ash.

MAROON.

Ten per cent immedial maroon B.; 10 per cent sulphide soda; 5 per cent soda ash; 35 per cent salt.

GREEN.

Ten per cent immedial green G G.; 10 per cent sulphide sodium; 3 per cent soda ash; 35 per cent salt.

BLUE.

Ten per cent immedial new blue G.; 20 per cent sulphide sodium; 5 per cent soda ash; 40 per cent salt.

ECRU

Three per cent immedial cutch G.; 4 per cent sulphide soda; 3 per cent soda ash; 20 per cent salt.

SCARLET.

Five per cent diamine scarlet B.; 30 per cent salt.

WINE.

Four per cent benzo fast scarlet 8 B S.; 1 per cent benzo fast violet R.; 30 per cent Glauber's; 3 per cent sal soda.

PINK.

One-half per cent Erika pink; 20 per cent Glauber's; 2 per cent sal soda.

SKY BLUE.

One per cent diamine sky blue F F.; 25 per cent Glauber's; 2 per cent sal soda.

HELIOTROPE.

One per cent diamine violet N.; 30 per cent Glauber's; 3 per cent soda.

TIRE FABRICS

Tire fabrics are, as the name implies, used for automobile, bicycle and other vehicle tires.

They are not actually tires themselves, but form the base or foundation of some kinds of composition and pneumatic rubber tires.

Like other terms denoting the use to which the fabric is to be subjected, as quiltings, bedspreads, shirtings, etc., the term tire fabrics covers a wide range of weights and qualities.

The stock used in the warps for these goods is of good quality, although the single yarns used are not of very high counts.

The weights vary considerably, ranging from about three to 20 ounces per square yard. In one type of goods this excessive variation is due almost exclusively to the ply warp yarns, which vary from 2 to 12 ply, from single yarns varying from about 8s to 40s, according to the weight required. This type of tire fabric is termed thread fabric.

ANALYSIS.

The analyses of two tire (thread) fabrics of widely varying weights show the following data:

Sample No. 1. Warp ends per inch in reed, 16. Reed, 16; one end in each dent.

Warp yarn, 11-ply 9s cotton.

Filling: One pick per inch of single 40s cotton.

Finished weight per square yard, 13.5 ounces.

The weave is plain. The drawing is in straight order.

One peculiarity of this class of tire fabrics, which will be noticed from the preceding data, is that the filling is used merely to keep the warp yarns in position, not being needed to give strength to the cloth.

Sample No. 2. Warp ends per inch in reed, 68.

Reed, 17; 4 ends in each dent.

Warp yarn, 2-ply 24s cotton.

Filling: One pick of 40s filling every three-quarters of an inch.

Finished weight per square yard, 3.9 ounces.

The ends in Sample No. 2 were drawn 2 as 1 through each heddle eye, in straight order, two picks completing the weave as in an ordinary plain cloth.

For a better quality of fabric with the same construction the yarns would have been drawn in straight order, reeded two ends in each dent, as

```
|       | 3  4 |       | 3  4 |
| 1  2  |      | 1  2  |      |
```

Fig. 1.

shown by the vertical lines in Fig. 1, and actuated as indicated by chain draft Fig. 2.

```
   x x
 x     x
```

Fig. 2.

By this arrangement the ends working together would have been split or separated with the reed and prevented from rolling over each other.

If woven on a cam loom working four harnesses, the drawing in and reeding would be as indicated in Fig.

```
    |    3 | 4    |    3 | 4
  1 | 2    |    1 | 2    |
```

Fig. 3.

3, and the lifting of the harnesses as indicated in Fig. 4

```
     x x
 x x
```

Fig. 4.

Reed ends at lines in Fig. 3, two ends in each dent.

LOOM REQUIRED.

Tire fabrics may be woven on heavy ordinary one-shuttle cam or dobby looms, there being but one warp and one filling, provided provision is made for the proper regulation of the let-off and take-up motions.

On the heavy grades of goods, it is advisable to fold the woven fabric as it is made, instead of running it on a cloth roller, on account of the large yardage produced in a short time.

The two samples analyzed were woven on a heavy loom running about 90 picks per minute.

Carding and Spinning Particulars.

In a previous article the cotton mills were divided into three divisions, each division having a different equipment of machinery. The mills that make tire fabrics do not come under the head of any of these divisions, but may be classed among those having a special equipment. This is on account of the extra length of staple used, which is very rarely less than 1½ inches, and from this up to the longest staple grown, 2¼ inches. The stock is, of course, Sea Island. It will therefore be readily understood that the machines in use in the other divisions of mills, having drawing rolls, such as drawing frames, slubbers, fly frames, etc., could not spread the bottom steel rolls the required distance, so as not to break the staple. In order to do this, specially constructed frames have to be obtained, which allow this spread of rolls.

ANOTHER POINT

is that the one main object sought is strength and this is the chief reason why long staple is used, the counts of yarn being extremely low for the length of the stock, i. e., 2-24s warp and 40s filling, so that the additional points that should be looked out for, besides those that will be given below, are to see that the top clearers cover all the top rolls, that the spread of the rolls is enough so that the staple will not be broken, and that the traverse motion is in perfect shape and working properly.

As it is strength that is sought, the cotton is

GENERALLY COMBED

to get all short staple out, but sometimes the stock is only carded. When carded, the carding should be light or, better still, double carding should be used. In this article we will consider the yarn to be combed. The mixing should be done by hand, the cotton being first stapled to see that it is up to standard, which for this article will be considered as 1¾ inches. The cotton, after being allowed to dry out, is put through an opener and either one or two processes of picking, generally one. If one process is used, the lattice

is marked off into sections of one yard each and an equal amount of cotton put onto each section to make the required weight lap in front. If two processes are used, the opener is combined with the breaker picker. The speed of the beater of the breaker picker should be about 850 revolutions per minute for a two-bladed rigid type. The total weight of the lap at the front should be 32 pounds or an 8½-ounce lap. These laps are doubled four into one at the finisher picker; the speed of this beater should be 800 revolutions per minute. The total weight of lap at the front should be 27 pounds or a 9-ounce lap. A variation of not over 6 ounces either side of standard should be allowed. All laps outside this variation should be run over. The picker laps are put up

AT THE CARD.

On this class of work the draft of the card should not be less than 140 and from this up to 180. The wire fillet used should be No. 120s for the cylinder and No. 130s for the doffer and top flats. The speed of the cylinder should be 160 revolutions per minute, licker-in 200 revolutions per minute, and top flats should make one complete revolution every 35 minutes. Cards should be stripped three times a day, although some overseers claim that stripping of the cylinder twice and the doffer three times a day is plenty. The cards should be ground once a month or oftener if wire is dull. For this class of goods keep wire fillet as sharp as possible. Use close settings except that of the feed plate to the licker-in, which should be set so as not to break the staple. Pull the staple at the back and front of card at least once a day to see that the length of staple is the same in both places. The weight of the sliver at the front should be from 35 to 45 grains per yard, 45 grains being a good weight.

THE PRODUCTION

should be about 300 pounds per week of 60 hours. Keep front of card clean, so that the short fly, etc., will not get into the good carded cotton. The cotton is next put through the sliver lap machine, where it is doubled 20 into 1 for a 10½-inch lap, or 14 into 1 for an 8¾-inch lap. We will consider that the lap being made is a 10½-inch lap used on an eight-head comber. Set the bottom steel rolls as follows: Front roll to middle, 2 inches; middle roll to back, 2½ inches. In combing this cotton, the instructions given in a previous lesson may be followed with the following exceptions. The weight of the sliver lap per yard is 275 grains; at the ribbon lap 260 grains per yard. The cotton lap is next put through the comber. The

SPEED OF THE COMBER

for this stock should be about 85 nips per minute. The doublings are 8 into 1 (for an eight-head comber). The percentage of waste taken out is from 25 to 30. Use close settings, 18 from half lap to segment and 21 from top comb to segment. The sliver at the cam should weigh 45 grains. After the comber use three processes of drawing, the spread of the rolls being as follows: 1⅞ inches from front to second; 2 inches from second to third roll; 2¼ inches from third to back roll. Look to the top leather covered rolls to see that they are in perfect shape and properly varnished. The weight of the sliver at the front of the finisher drawing should be 60 grains per yard. The doublings at the drawing should be 6 into 1. At the slubber this drawing should be made into .70 hank roving. At this frame

SEVERAL CHANGES

are made, which are as follows: The top leather rolls are varnished, sometimes all three sets, and sometimes only the front rolls. The size of the front leather roll is sometimes increased to 1½ inches. This is to help prevent the roving "licking up"; when this is done, top clearers similar to those on mules are used. The slubber roving is put through two processes of fly frames and made into the following hank roving: 2.25 at the first intermediate and 5 at the second for the 40s cotton, and for the 24s cotton the hank roving at each frame is as follows: 2.25 at the first and 8 at the second intermediate.

The spread of the rolls should be as follows: Front to middle, $1\frac{3}{8}$ inches; middle to back, 2 inches. It should be understood that when giving the spread of the rolls, the distance is from center to center. The warp yarn is then spun into 24s on a warp frame having a 2-inch diameter ring and a 7-inch traverse. Some overseers give a little more than standard twist to this yarn. The yarn is then put through the spooler and from here to the twister, where it is made into 2-ply yarn. From here it is put through the warper and the slasher. The filling yarns may be either mule or ring spun; if spun on a ring frame for 40s yarn, use a $1\frac{3}{8}$-inch ring and $5\frac{1}{2}$-inch traverse. This yarn is then conditioned, when it is ready to weave.

PLAIN and PLAIDED NAINSOOK

Nainsook is a light cotton fabric, utilized for numerous purposes, such as infants' clothes, women's dress goods, lingerie, half curtains for dining rooms, bathrooms and for various other purposes. The striped or plaided nainsook is used for the same purposes as the plain fabric, depending upon the tastes of the consumer. Where the fabric is required for lingerie and infants' wear, the English finished fabric is selected because of its softness. When intended for curtains or dress fabrics the French finished fabric is chosen; the latter finish consists of slightly stiffening and calendering the fabric.

The name nainsook is derived from the Hindoo Nainsukh and was originally defined as a stout India muslin, manufactured in India.

The fabric as manufactured to-day may be distinguished from fine lawns, fine grades of batiste and fine cambrics from the fact that it has not as firm construction, or as much body, and the finished fabric is not as smooth nor as stiff, but inclines to softness, principally because it has not the body to retain the finishing materials used in finishing the fabric; consequently it must needs be a cheaper article than the fabrics above mentioned. Nainsook, like most cotton fabrics, is made in several grades, the different grades being affected by the counts of yarns used, which in turn influence the ends and picks per inch in the construction.

ANALYSIS.

Width of warp in reed, $30\frac{1}{2}$ inches; width of fabric finished, $28\frac{1}{4}$ inches;

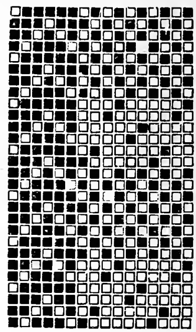


Fig. 1.

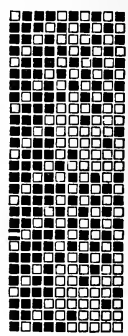


Fig. 2.

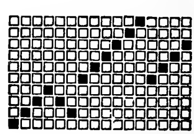


Fig. 3.

ends per inch in reed, 82, reeded 2 in 1 dent; ends per inch finished, 86; ends in body, 2,460, plus 40 ends selvage, equals 2,500, total ends in warp; take-up during weaving, 5 per cent; weight

of fabric, 1½ ounces per yard; warp yarn, 1-50s cotton; filling yarn, 1-64s cotton; 66 picks per inch in loom; 64 picks per inch finished. Fig. 1, design; Fig. 2, chain draft; Fig. 3, drawing-in draft.

LOOM REQUIRED.

Nainsook, like various other one-filling fabrics of the character under discussion, may be woven on any light, single box, high speed loom.

Plaided nainsook seems to imply the use of more than one filling, the plaid, however, is formed by the weave. See design Fig. 1.

FINISHING.

This fabric is given either what may be termed an English or a French finish. By the former finish the fabric, after it comes from the loom, is boiled off, then bleached, after which it is softened by immersing in a light solution of glycerine, or cocoanut oil, and flour or farina, after which it is dried by passing over heated cylinders, then run through a rotary press with very light pressure. In the French finish, after the fabric is bleached, it is stiffened by immersing in a solution of size, composed of the following ingredients: flour, wax and gelatine, after which the fabric is dried, then slightly sprinkled with water, then run through the calender, which completes the finishing process.

Carding and Spinning Particulars.

One mill making the above style of fabric makes its warp and filling yarn as described below. This mill is included in the second division as given in a previous article. Its equipment includes both combers and a bale breaker. The stock used is 1¼-inch good quality Allen seed cotton. The cotton is put through three processes of picking and an opener. The opener is connected with the breaker picker. This picker is provided with a two-bladed rigid type of beater, which rotates at 1,500 revolutions per minute. The weight of the lap at the front of this beater is 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. This picker is also provided with a two-bladed, rigid beater, the speed of which is 1,450 revolutions per minute. The total weight of the lap at the front of this picker is 38 pounds or a 12½-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. It is at this point that the cut-roving waste is mixed in, it having first been put through a roving picker and a picker to form it into a lap.

THESE ROVING LAPS

are mixed in with the raw stock in proportion of three laps raw stock to one lap cut waste. The beater used on this picker is a two-bladed, rigid type and its speed is 1,400 revolutions per minute. This gives the cotton passing through the picker about 42 beats or blows per inch. The total weight of the lap at the front is 36 pounds or a 12½-ounce lap. The laps are next put up at the card. This card is provided with a 26-inch doffer. The speed of the licker-in is 350 revolutions per minute, flats one revolution every 43 minutes. The draft is 100. Cards are stripped three times a day, ground twice a month, and the wire fillet used is No. 34s for the cylinder and 36s for the doffer and flats. The weight of the sliver at the front of the card is 50 grains and the production is 600 pounds per week of 60 hours. This mill is equipped with 6-head, 8¾-inch lap combers.

THE SLIVER

from the card is doubled 14 into 1 at the sliver lap machine and the weight of the lap is 320 grains. These laps are put up at the ribbon lap and doubled 6 into 1, the weight per yard at the front being 275 grains. These are put up at the comber and doubled 6 into 1, the weight of the lap at the can being 40 grains per yard. The speed of the comber is 90 nips per minute and 18 per cent of waste is taken out. The sliver is then put through two processes of metallic top roll drawing frames, the weight of the sliver at the finisher drawing being 70 grains per yard. The speed of the front roll is 375 revolutions per min-

ute. The drawing is then put up at the slubber and drawn into .55 hank roving. This is then put through three processes of fly frames and made into the following hank roving at each frame: First intermediate 1.50, second 4, and jack frame 12 hank. The bottom steel roll

SETTINGS

are as follows: Front to second, 1⅝ inches; second to back, 1½ inches. The front top rolls of the slubber are varnished. The roving is next taken up to the ring spinning room and made into 64s for filling and 50s for warp. For spinning 50s warp yarn use a frame having 2¾-inch gauge, 1½-inch diameter ring, 6-inch traverse, and put in 31.71 turns or twists per inch. The spindle speed is 10,000 revolutions per minute. This yarn is then put through a spooler and a warper and then a slasher. The filling frame to spin 64s should have a 2¾-inch gauge, 1¼-inch diameter ring, 5-inch traverse, 27 twists per inch and a spindle speed of 7,700 revolutions per minute. This yarn is taken to the conditioning room and then it is ready to be woven.

SPOT and STRIPES

Produced by Means of an Extra Warp.

The spot or stripe may be effected by the weave alone or by means of extra warp and filling. The latter method of constructing these fabrics will be considered. Fabrics of this character are made in a variety of qualities —from an "all cotton" to a very fine woolen or worsted fabric. The elaboration of the spot or stripe is largely influenced by the material used in the body of the fabric. The rule with few exceptions is, the finer the quality of the material, the more elaborate is the stripe or spot.

THE SPOT PATTERN.

The spot is effected by floating the extra warp or filling yarn on the back of the goods for a given space, then raising the extra yarn to the face of the fabric for a given number of picks. The size of the spot depends on the number of picks or ends which the extra yarn floats over, which may be only one, two or more picks or ends. This, of course, is the simplest form of the spot pattern.

The simplicity of this method of construction lends itself readily to some very neat effects in small spot patterns; for example, by using different colored yarns for the spot, arranged in some order, on a ground

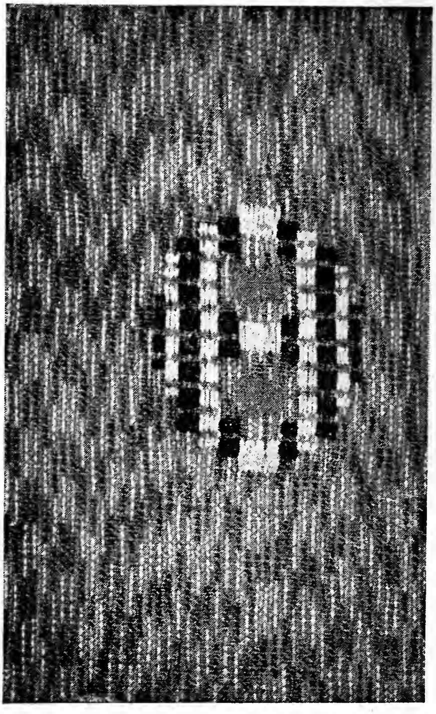


Fig. 1.

composed of a 4 x 4 herringbone weave, with ground color scheme as follows: 4 ends green, 4 ends black, 4 ends brown, 4 ends black, with the same arrangement in the filling. The spot yarn may be composed of several colors, as, for instance, red, white and yellow.

In making the spot, with extra warp yarn only, the spot yarn is usually directly under the lightest ground color

and forms the spot at the junction of light ground colors, referring tc ground color scheme given above.

The spot yarn comes to the face of the fabric where green crosses green for two picks, then floats on back until the alternate crossing of green. This form of spot is operated on but two harnesses. The more elaborate spot is formed on the same principle as the small two-pick spot just mentioned; the elaboration consists of the use of more ends. These ends are woven in in the form of a figure, which requires the use of from 4 to 12 harnesses and more, in order to form the spot. These large spots are usually woven on a plain ground weave. The pattern would be read: 1 end of ground, 1 end of figure or extra yarn. The figure could be removed without affecting the ground weave, by reason of the fact that the spot is formed entirely by extra yarn. The spots are woven in the cloth in some order; for instance, they may be based on any satin, broken twill, or plain weave order.

Fig. 1 is a sample of spot pattern formed by extra warp yarn.

RAISED STRIPE PLAID.

These fabrics are much in use as a dress fabric for children and are made in all cotton, worsted and cotton, and all-worsted, with the exception of the raised stripe, which is usually mercerized cotton or silk.

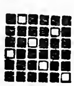


Fig. 2.

The raised stripe is formed by the use of partially extra yarn in both warp and filling, that is to say, if a stripe is formed with 12 ends, these 12 ends would be reeded so as to take the place of only 8 ground ends; for example, if ground is reeded 2 in 1 dent, the stripe is reeded 3 in 1 dent.

If we use for ground weave $\frac{1}{\quad 2}$ twill, the raised stripe must be a weave that is divisible by 3—the number of ends in the repeat of ground weave; in order to produce perfect stitching, a 6-end irregular satin would be required.

In laying out the pattern, or color arrangement, it should be observed

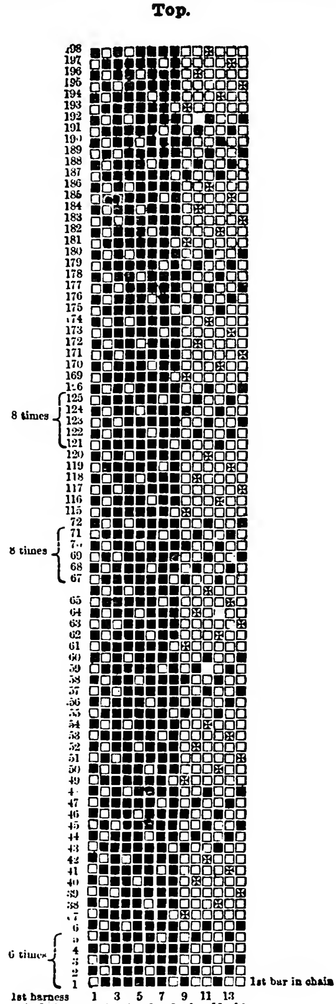
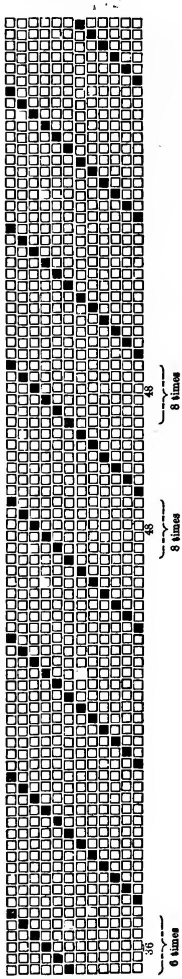


Fig. 3.

that the pattern is divisible by 6, and that the number of ends between the raised stripes in both warp and filling

is divisible by 6, otherwise imperfect stitching will result when using a $^{1}\underline{\quad}_{2}$ twill for ground weave.

These fabrics are made in various widths; the cotton goods are set usu-



Draft

Fig. 4.

ally at 38 inches in reed, and finish at 36 inches.

ANALYSIS.

1,000—2 reed; picks 54, with stop take-up.

WARP AND FILLING PATTERN.

36	ends bleach cotton.
4—6	ends blue cotton mercerized.
6	ends bleach.
4—6	ends blue.
6	ends bleach.
4—6	ends blue.
30	ends scarlet.
12	ends green, start 12.
4	ends black.
2	ends bleach.
4—6	ends scarlet.
2	ends bleach.
4	ends black.
12	ends green, end 12.
30	ends scarlet.
4—6	ends blue.
6	ends bleach.
4—6	ends blue.
6	ends bleach.
4—6	ends blue.
198	
14	ends extra yarn for stripe.
184	

Fig. 3 required chain draft.
Fig. 4 drawing-in draft.

Ends in warp.		Ends in pattern.	
708	bleach	64	2-40 cotton.
660	scarlet	60	2-40 cotton.
288	green	24	2-40 cotton.
396	blue	36	2-40 mercerized cotton.
72	scarlet	6	2-40 mercerized cotton.
144	black	8	2-40 mercerized cotton.
2,268		198	ends in 1 pattern.
2,268	total ends in warp.		

The pattern shows that we have 198 ends and picks taking up the space required for 184, or 14 ends and picks of extra yarn in each pattern require average picks per inch in fabric: 54 pick wheel—198 in place of 184; 184 : 198 : : 54 : x equals 58 picks.

To calculate filling material required for 10 yards of cloth:

PATTERN.

64	A
60	B
24	C
36	D
6	E
8	F
198	
184	
38	inches in reed.
54	pick wheel.

2,052 ÷ by 184 = 11.15 average yards of yarn of colors in 1 yd.

11.15	
10	yds.
111.50	
5.58	5% added for waste.
117.08	

117.08
64

	Weight of each color.
7,493.12 yds. of color A—	7.13 ozs.
7,024.80 yds. of color B—	6.66 ozs.
2,809.92 yds. of color C—	2.66 ozs.
4,214.88 yds. of color D—	4.01 ozs.
702.48 yds. of color E—	.70 ozs.
936.64 yds. of color F—	.90 ozs.
	22.06 ozs. of filling for 10 yds. of cloth.

2-40s mercerized filling = 16,800 yards to 1 pound.

LOOM REQUIRED.

These fabrics require the use of box looms; a 4 x 1 or 6 x 1, or pick and pick loom, that is, a 4 x 4 box loom, is much used. If 6 colors are in the warp pattern, a 6 x 1 box dobby loom should be used. In the cheaper grade of plaids a 6-color warp pattern is sometimes filled with only 4 colors; this necessitates that one filling color covers two warp colors. A little discretion along this line will enable the manufacturer to use a 4 x 1 box loom where a 6 x 1 should be used. This, however, is only practiced in the cheaper grade of fabrics.

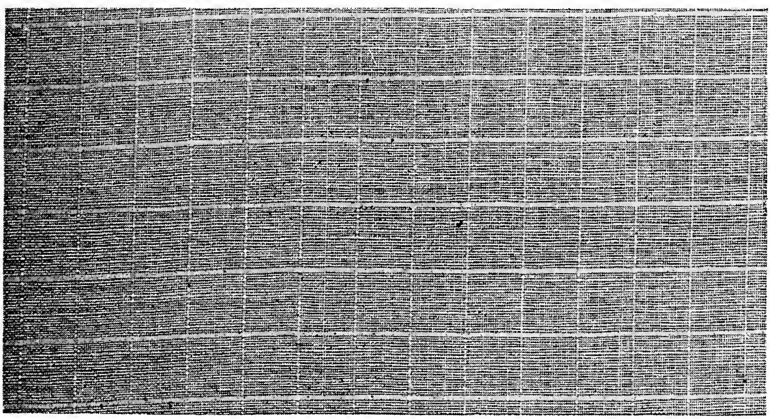
FINISHING.

These fabrics, if made with worsted are given a light scouring, then pressed. In the large spot patterns the extra yarn that floats on the back, when not forming the spot, is cut off by means of a shearing machine. The cotton fabrics are usually given a dry finish—simply run through a rotary press with slightly heated cylinders, and slightly steamed before passing over the cylinder of the press—after which they are made up into small rolls, then shipped.

Carding and Spinning Particulars.

The mills making the yarn for these fabrics will be found in either the first or second division of mills, as given in a previous article.

The yarns of which this class of goods is made vary a great deal, some of the finer ones being combed. For this article we will consider the warp and filling to be carded 2-40s yarn made from a 1 3-16-inch staple peeler cotton of a good grade. The raw stock is mixed by hand, although, if done by a bale breaker, it is better, as has been before stated; especially is this true in rainy or muggy weather. The mixings should be as large as possible and the hands mixing the cotton should break the bale into as small parts as possible.



Stop Peg Check.

IN HAND MIXING

several bales should be opened at once, and the cotton from each mixed together. At this point the sliver waste is mixed in with the raw stock.

This should be thoroughly spread over the entire mixing. The cotton is put through an opener and three processes of picking. Always keep hopper of opener more than half filled with cotton, so as to obtain as even a feed as possible.

After passing through the opener the cotton is fed on to an endless lattice, which carries it to the feed rolls of the breaker picker. These condense the cotton and present it to the action of the beater. This beater is generally the two-bladed rigid type of beater and its speed is 1,550 revolutions per minute. Look at the

GRID BARS

to see that they are properly spread and the dirt is going through them and not being drawn into the cotton again after being knocked out by the beater. Do not allow the dirt to collect under picker, especially under the grid bars, as it is liable to be drawn into the cleaned cotton by the draft. The total weight of lap at the front of the breaker is 40 pounds or a 16½-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. This picker is also generally provided with a two-bladed rigid type of beater, whose speed is 1,500 revolutions per minute. The total weight of the lap at the front of this picker is 38 pounds, or a 12½-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. It is at this point that the

CUT-ROVING WASTE

is mixed in. If the mill contains a cut-roving waste picker the proportion of mixing is as follows: Three laps raw stock to one lap cut roving. If, however, there is no such machine, the two center laps are taken out and the cut roving spread evenly over the surface of the last lap. This will, of course, bring the waste between two laps of raw stock. The beater of this machine is a rigid, two-bladed beater and makes 1,450 revolutions per minute, which gives the cotton passing through the machine 41½ beats per minute. The total weight of this lap at the front is 36½ pounds or a 12-ounce lap. The variation allowed for this kind of work is one-half pound either side of standard. Laps weighing over or under this variation are put back to be run over again. These laps are put up

AT THE CARD.

This card should have a draft of not less than 100. The end is set for medium work and uses the medium count of wire fillet for wiring doffer flats and cylinders. Set the doffer (which should be as large as possible) from the cylinder with a 7-1,000-inch gauge. The flats of the cards should make one complete revolution every 45 minutes. The cards should be cleaned thoroughly twice a day and the front wiped off many times more, to keep fly from falling back into good work. Strips should be collected at regular intervals which should not be so long apart as to allow the fly to accumulate so that it is liable to fall over on the doffer or be drawn up into the flats. This it cannot do if cards are equipped with a waste roll. The sliver at the front should weigh 60 grains per yard and the production should be about 750 pounds for a week of 60 hours. Strip cards three times a day (twice in morning and once in afternoon) and grind all over once every three weeks.

DRAWING.

The cotton is next put through three processes of drawing frames. These frames may be equipped with leather top rolls or metallic top rolls. If the former, be sure to see that the rolls are well covered and in perfect condition and well varnished. The frames should at least receive a set of front top rolls every week. The speed of the front roll should be about 350 revolutions per minute. The frames may be equipped with metallic rolls to good advantage and, if they are, care should be taken to keep the flutes free from dirt of all kinds. The weight of the drawing sliver at the front of the finisher drawing frame should be 75 grains per yard. The cans of sliver are put up to the slubber and spun into .50 hank roving. Varnish the front loose top rolls of the slubber. The other sets of top rolls may also be varnished, but they are not so im-

portant. Keep rolls properly covered, oiled and weighted. Look out to see that no cut work is being made. After passing through the slubber the cotton is put through three processes of

FLY FRAMES

and made into the following hank roving: At each first intermediate, 1.50; second intermediate or roving frame, 4, and jack frame 8 hank. Be careful to see that proper twist is being put in, just enough so that the roving will not break back at the succeeding process. The method of finding the standard for twist has been given in a previous article. Another point is to see that the tension is right, because, if it is too much, the roving will be apt to be strained, while, if too slack, a soft bobbin will be made. Keep top leather rolls in good condition, as well as spindles well oiled for good roving. After having passed the fly frames the roving is taken to the

RING SPINNING FRAME

and spun into 40s yarn. If spun on a warp frame, use a frame having a 1⅝-inch diameter ring, 6½-inch traverse, twist per inch of 28.46, and spindle speed of 10,000 revolutions per minute. If spun on a filling frame use a frame having a 1¼-inch diameter ring, 5½-inch traverse, twist of 23.72 and spindle speed of 8,800 revolutions per minute. The yarn is next twisted into 2 ply at the twister and then the warp yarn is run on a chain warper; from here it is taken and dyed, after which it has to be warped again on a beam.

Dyeing Particulars.

Following are the dyeing particulars on cotton yarn and mercerized yarn:

SCARLET.

Four per cent direct scarlet A.; 30 per cent common salt.

MAROON.

Three and one-half per cent direct maroon B.; 30 per cent common salt.

PINK.

Three-quarters per cent direct pink 7 B.; 20 per cent salt.

YELLOW.

Three per cent chromine G.; 30 per cent salt.

GREEN.

One and one-half per cent naphtamine green 4 B.; 25 per cent salt.

NAVY BLUE.

Four per cent naphtamine blue 2 B.; 30 per cent salt.

LIGHT BROWN.

One-half per cent naphtamine brown N conc; ½ per cent naphtamine yellow N N conc; 20 per cent salt.

SKY BLUE.

One per cent diamine sky blue F F.; 30 per cent Glauber's salt.

ORANGE.

One per cent naphtamine orange O.; 30 per cent Glauber's salt.

LIGHT OLIVE.

Three-quarters per cent direct olive R.; ¾ per cent naphtamine yellow N N conc; 30 per cent Glauber's salt.

BROWN.

One per cent naphtamine brown 6 B.; 2 per cent naphtamine yellow N N.; 30 per cent salt.

SLATE.

One and one-half per cent naphtamine black N.; 20 per cent salt.

BOTTLE GREEN.

Five per cent naphtamine black 2 G.; 1 per cent naphtamine yellow N N.; 30 per cent salt.

BLACK.

Five per cent naphtamine black D.; 30 per cent salt.

HELIOTROPE.

One-quarter per cent heliotrope B B.; 20 per cent Glauber's salt.

ECRU.

One ounce naphtamine brown N.; 2 ounces naphtamine yellow N N.; 20 per cent salt.

TARTANS

Tartans, also termed tartan plaids, or Scotch plaids, are highly colored fabrics, the distinguishing effect being large plaid or check effects formed by two or more colors of warp and filling, more particularly containing such prominent colors as red, yellow, blue, orange, green, purple, primary and secondary colors and other showy colors, to a greater or less degree. Pure blacks and whites are also used.

THE MATERIALS

used are yarn dyed. The weaves used are usually the plain, $\frac{2}{2}$ twill $\frac{2}{2}$ basket, $\frac{3}{3}$ twill, $\frac{3}{3}$ basket, and rearrangements of or combinations of these weaves, which distribute the warp and filling in equal proportions on both sides while retaining a firm structure of cloth.

The Mayo or Campbell weave, Fig. 1, and the 6-end twill and 6-end bas-

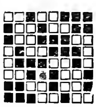


Fig. 1.

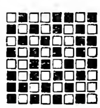


Fig. 2.

ket are used for the finer grades of goods.

Tartans, although sometimes made with cotton yarns, are more extensively made with worsted. They are also made with other fibres.

References to tartans being used for wearing apparel are found in literature, dating back to the 15th century.

At the present time tartans are used, as of old, for ladies' dress goods, and also for a certain type of garment for men, well known where Scotchmen have found their way.

The word tartan is of doubtful origin, some historians claiming one and some another. For several hundred years it has been connected with cloths made and worn principally by people in the Scottish highlands.

The Highlanders were formerly divided into sections, or clans, each of which had its own special tartan, the latter varying in the arrangement of colors, or of the colors themselves, or of both, from those used by the other clans.

The Scottish clans and their tartans have been ably and extensively dealt with in literature, books having been published on the subject, to which the reader is referred for more detailed information. In some of these publications the illustrations show the principal tartans in their several colors.

A collection of tartans of good quality is one of the best aids in studying the pure color combinations that can be obtained.

It is said that the tartan, no matter of what colors or arrangement of colors the plaid may be composed, signifies the brotherhood of the various Scottish clans.

THE SIMPLEST FORM

of tartan is in two colors, arranged so many ends in one color and an equal number of ends of another color in the warp, the arrangement of filling being similar to the warp, making blocks of equal size.

The combinations of colors, or arrangements of yarns, may vary as desired.

From this base an infinite variety of variations can be made; 4, 5 and 6-color tartans are commonly made.

In a tartan made in six colors, red, yellow, blue, green, black and white, with the exception of the yellow and white ends, which work $\frac{7}{1}$, the weave is as shown in Fig. 2.

A tartan with a prominent weave effect, as in this instance, is something unusual. The idea here seems to have been to get a stripe effect.

To produce said tartan, 16 harnesses would be required, 8 for the ground, 6 for the warp float and 2 for the selvages. The sections working $\frac{7}{1}$ work in 8-end sateen order; the largest contains 6 ends, therefore 6 harnesses only are required.

Being a fabric characterized by color effect, tartans are made to vary in quality, width, weight and finish to a considerable degree, according to requirements. In cotton goods they are usually developed in medium counts of yarn, from say 20s to 40s.

One requisite for weaving tartan fabrics is a loom with two or more shuttle boxes at one end. For almost all of the patterns a single box will answer at the other end.

The harness motion of the loom will differ according to the weave required. For a plain weave tartan, an ordinary 2-cam gingham loom will answer; in fact, about the only difference between a tartan and a gingham is that the colors of the former are brighter than those of the latter, and yarns of only one count are generally used, one warp only being required, whereas in a gingham it is quite common to have yarns of varying counts in both warp and filling.

A tartan plaid is also larger, as a rule, than a gingham check.

A cam box loom would also suffice for weaving 4-harness twill and derivative weaves, although it might be preferable in the case of the latter to use a dobby loom on account of the cross drawing in that would be necessary.

For fancy weave tartans, which are in the minority, a box loom with a dobby head is required.

LONG CLOTH

Long cloth is a fine cotton fabric of superior quality, made with a fine grade of cotton yarn of a medium twist. Originally, the fabric was manufactured in England and subsequently imitated in the United States.

The fabric is used exclusively for lingerie and long dresses for infants, from which it has apparently derived its name.

Long cloth to some extent resembles such fabrics as batiste, fine grades of muslin, India linen and cambrics. It is distinguished from these fabrics by the closeness of its weave and when finished, the fabric possesses a whiter appearance, due to the closeness of the weave and the soft twist yarn. The fabric, while possessing fair weaving qualities, is, however, not used as a dress fabric, chiefly because of its finished appearance, which is similar in all respects to fabrics we have been accustomed to see that are used solely for lingerie, night gowns, etc.

Long cloth, like the fabrics enumerated above, is made in a variety of grades or qualities. It is a very common thing in textile manufacturing to vary the grade of a fabric; not simply because the manufacturer loves to do so, but because of necessity, competition, etc.

THE SOLE PURPOSE

of the manufacturer is to produce a fabric that will sell and in order for a fabric to sell, it must be attractive and reasonable in price; the price which a manufacturer can command determines precisely how he must construct any fabric which he may offer to the consumer; if he finds, for instance, that long cloth is more salable at 12½ cents a yard than at 15 cents, it follows that he must make it at the former price. In order to make it profitable at 12½ cents per yard he must either use a cheaper grade of yarn or make a slightly lighter fabric, by using a fine count of yarn, which will produce more yards of cloth per pound of yarn; thus are brought about the various grades and qualities of fabrics.

The public is sometimes badly mistaken when it imagines it buys precisely the same fabric at 12½ cents which some other concern is offering at 15 cents per yard.

Following is an

ANALYSIS OF A FABRIC

which sells at 15 cents per yard.

Width of warp in reed, including selvages, 37½ inches. Width of fabric finished, 36 inches; ends per inch finished, 100; ends per inch in reed, 96; ends in warp without selvages, 3,600; ends in selvages, 40; total ends in warp, 3,640.

Take-up of warp in weaving 8 per cent; weight of finished fabric 2.5 ounces; warp all 1-50s cotton; filling all 1-60s cotton.

Picks per inch finished, 88.

Picks per inch in loom, 90.

LOOM REQUIRED.

A factor of supreme importance in the production of light cotton fabrics is the loom facilities available; such

fabrics as long cloth and fabrics closely allied in character are woven most profitably on high-speed looms, or an automatic loom.

Long cloth is but a plain woven fab-

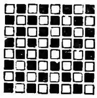


Fig. 1

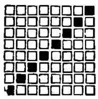


Fig. 2

ric (Fig. 1 design; Fig. 2 drawing-in draft) and is usually woven with eight harnesses, owing to the number of ends per inch, which would overcrowd the heddles and cause the yarn to chafe and break if less harnesses were used. The yarn is sized before the warp is beamed. The sizing is merely to strengthen the yarn. For light sizing it is not necessary to use anything but wheat flour, farina, or sago and a small quantity of softening material, usually tallow or wax.

FINISHING.

After the fabric is woven it is sent to the bleaching house. The first process is to boil it, then it is bleached. After the bleaching process the fabric is subjected to a very light sizing. The most prominent of the sizing ingredients is the softening material used, which may be glycerine, paraffine, cocoa oil, olive oil or bees' or Japan wax.

After the fabric is sized it is run through a rotary press, the cylinders of which are only slightly heated, with equally as little pressure on the fabric. The cloth is then folded, after which it is ready for the market.

Carding and Spinning Particulars.

The yarns for this fabric are made in the second division of mills, as given in a previous article. Long cloth is also sometimes made in the better equipped mills of the first division. The raw stock used is generally Allen or peeler cotton, the average length of staple of which does not exceed 1¼ inches in length. In some grades of long cloth the filling yarn is combed, but as it is the more general custom to use a carded yarn, we will work on this basis. Make the mixings as large as possible. After being mixed the cotton is put through three processes of picking and an opener. Keep the opener hopper

WELL FILLED,

so that the pin beater will always have to strike some of it back. A well-filled spiked lifting apron means an even amount of cotton being fed to the breaker picker and therefore a more even breaker lap. For this class of cotton a three-bladed, rigid type of beater is best. The speed of this beater should be about 1,050 revolutions per minute, as this class of cotton is generally very dirty and requires an extra amount of beating in the breaker and intermediate pickers so as to get a good, clean lap. The weight of lap at the front of the breaker picker should be 40½ pounds. These laps are put up and doubled 4 into 1 at the intermediate picker. The beater used on this picker, to get good results, should be a two-bladed, rigid type, the speed of which should be 1,500 revolutions per minute. The weight of the lap at the front should be 38 pounds or a 12-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. It is at this picker that the

CUT-ROVING WASTE

is mixed in in the proportion of three laps raw stock to one lap roving waste. If the mills are not provided with a roving picker, the third lap is taken out and the roving fed on top of the sheet that comes from the fourth lap. Do not use too much waste, because it tends to make split laps which cause trouble in licking and making single at the card. The beater of the finisher picker is generally a two-bladed, rigid type, the speed of which should be about 1,500 revolutions per minute. The total weight of the lap at the front should be 36 pounds or a 13-ounce lap. A variation of one-half pound, either standard, is

allowed for this work. The cotton passing through the finisher picker receives 42 beats or blows per inch. Put these laps up

AT THE CARD

which should have wire fillet for spinning medium counts of yarn. The draft of this machine should not exceed 115. The speed of the licker-in is 375 revolutions per minute and the flats make one complete revolution every 50 minutes. The percentage of waste and fly taken out is about 3.75 to 4. Use medium settings and be sure that the feed plate is not set too close so as to break the staple. The cards should be stripped as follows: Three times for cylinders and four for doffers per day. Grind cards all over at least once every three weeks, lightly, and set after having ground. The weight of the sliver at the front should be 60 grains per yard. The production on this class of goods should be 700 to 750 pounds per week of 60 hours. This sliver is put through three processes of drawing frames which may be either equipped with metallic or leather-covered top rolls. If leather top rolls are used a good receipt for

VARNISH,

which differs from those already given, follows: 8 ounces best flake glue, 8 ounces ground or flake gelatine, 3 pints acetic acid, 1 pound burnt or raw sienna, 1 ounce oil of origanum. In many mills trouble is often found with the laps of the leather rolls breaking or splitting apart when varnish is first put on. If the laps are painted with formaldehyde, using a fine brush for the purpose, it will be found to overcome this trouble. This not only applies to drawing frame top leather rolls but to all leather rolls that have to be varnished.

ANOTHER POINT

to look out for is when sending rolls away to be covered, all waste should be removed from the bearings, for, if this is not done, a rust spot will be on them when they are returned from the roll coverer. On the drawing frame on this class of work it will be found advantageous to use metallic top rolls. If used, keep the flutes clean and smooth. The speed of the front roll should be 375 revolutions per minute on all processes. The doublings are 6 into 1 and the weight of sliver at the front is 70 grains per yard. Size the drawing frames at least three times a day. The sliver is next put up at the slubber and made into .55 hank roving. From here it is put through three processes of fly frames and made into 11.50 hank roving at the jack frames. The hank roving at the different processes is as follows: First, 1.50; second, 4 and fine, 11.50. From here it is taken to the ring spinning room and spun into 50s yarn on a warp frame having a 2¾-inch gauge, 1½-inch diameter ring, 6-inch traverse, 31.81 twist per inch and a spindle speed of 10,000 revolutions per minute. From here it is spooled and warped and the required number of beams put up at the slasher to give sufficient end for the warp at the front. A good slasher size is as follows: Water, 100 gallons; potato starch, 65 pounds; tallow, 6 pounds; Yorkshire gum, three pounds; soap (white) two pounds. Boil 1¾ hours.

For the filling yarn the roving is spun into 60s on a frame having 2¾-inch gauge, 1¼ diameter ring, 5-inch traverse, 27 twist per inch and spindle speed of 8,000 revolutions per minute. This yarn should be conditioned

BUCKRAM

Buckram may be described as a coarse, glue-sized fabric made with cotton, linen, hemp or cotton and hair, the name in most cases being acquired by the finish which the fabric receives after it is woven. Some qualities of buckram are but plain woven cotton fabrics.

Buckram is used principally for stiffening garments, being much in demand by tailors, who use the fabric for stiffening and to give shape or form to a garment. The fabric is inserted between the lining and the surface cloth of the garment in particular parts, such as the lapel, cuff or wherever the shape of the garment is essential to its appearance. Buckram is

manufactured in several kinds; the fabric used for men's wear is usually made with linen, hemp or hair and cotton; the latter combination, namely, hair and cotton, is supposed to be the best, in so far that when bent or twisted it will spring back to its original position; this feature cannot be attributed to hemp or linen. The hair and cotton buckram is a loosely woven fabric, the hair figuring as warp, and the cotton as filling. It is usually woven in plain twills or herringbone weave. The filling is usually two

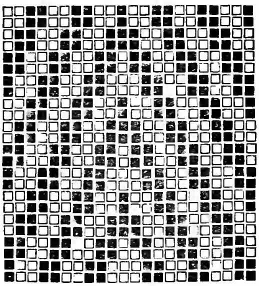


Fig. 1.

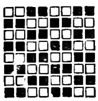


Fig. 2.

picks in one shed. (See Fig. 1, design.)

Buckram also figures largely in the millinery trade, where it is made up into hats. These hats are covered with chenille, plumes, flowers or whatever finery may be desired.

The buckram used for this purpose is a plain woven cotton fabric heavily sized, increasing its weight from 50 to 100 per cent. The odd feature of millinery buckram is that two separate fabrics are made into one during the finishing process by means of gluing or sizing them together; these two fabrics are of different texture. The top or face fabric closely resembles a fine cotton voile, while the back or bottom fabric might be termed a coarse tarlatan.

Millinery buckram is a piece-dyed fabric, usually in somber colors, such as dark red, garnet, dark green and black. In the hair and cotton fabric, which is principally used for men's wear, the cotton is dyed before it is woven.

COTTON BUCKRAM ANALYSIS.

Face or top fabric: Width of warp in reed, 38 inches; width of fabric finished, 36 inches; ends per inch finished, 40; ends per inch in reed, 38; ends in warp, 1,440; 19 x 2 reed; take-up of warp during weaving, 8 per cent; warp, 1-22s cotton; filling, 1-26s cotton; 34 picks per inch; weight from loom, 2.22 ounces.

Back or bottom fabric: Width of warp in reed, 41 inches; width of fabric finished, 36 inches; ends per inch finished, 16; ends per inch in reed, 14; ends in warp, 576; ends selvage, 24; total ends in warp, 600; 14 x 1 reed; take-up of warp during weaving, 5 per cent; warp, 1-12s cotton; filling, 1-10s cotton; 12 picks per inch; weight of fabric from loom, 1.86 ounces.

Weight of two fabrics after finishing, as one, 6.38 ounces; nearly 60 per cent added by sizing materials.

LOOM REQUIRED.

These fabrics may be woven on any light-built loom, the speed of which should be from 150 to 170 picks per minute. The warp for face fabrics is usually drawn on eight harnesses; the back fabric may be drawn in on four harnesses in the order of: 1, 3, 2, 4. The chain, if a dobby loom is used, must be built accordingly. (Fig. 2.) Chain required: 2 repeats.

FINISHING.

These fabrics, as previously mentioned, depend a great deal on the finishing which they receive. The men's wear buckram requires less sizing by reason of the strenuous ordeal to which it is subjected in the fulfillment of its purposes, and also because the warp, which is composed of hair, is in itself quite stiff.

Millinery buckram requires more attention. After the fabrics are woven, they are dyed; the finisher then must observe that the fabrics finish the same width, so that when sized or glued together one fabric will not extend beyond the other. To insure that

the fabrics lie evenly, they are stitched at the selvages by means of a sewing machine.

The fabrics are then subjected to the sizing process, with the back cloth to the roller, which revolves in the size; this allows the size to penetrate more readily, as the meshes of the back cloth are larger than the meshes of face fabric; the fabric is usually subjected two or three times in succession before it is finally dried.

The ingredients used in sizing are glue, flour and China clay. These ingredients are used in various proportions, the following being an example: 40 parts glue, 20 parts clay, 40 parts flour.

Carding and Spinning Particulars.

The yarns which make up buckram vary according to the quality of fabric, but, generally speaking, the yarns are what are called coarse. The yarns of this class of goods would be made in mills of the first division as given in a previous lesson. In coarse yarns quantity is the end sought for rather than quality. Of course, this does not mean that everything is dropped for quantity, but that as great a production as possible is made at each machine and still get the desired quality for the class of goods being made. In fact, the machines are set to produce this result. For this article we will consider the buckram to be what is called "cotton buckram" and made up of all-cotton yarn. Other kinds of buckram are made which have only one or both filling and warp back yarns of cotton fibre. The latter are made up of very coarse counts of yarns, generally about 1-10s. Cotton buckram is made up of finer yarns, and for this article we will consider the count to be 1-22s for the warp and 1-26s for the filling yarns. Both these yarns are made up of the same staple cotton, generally a low grade of American cotton being used of about three-quarters-inch staple.

MIXINGS.

Waste is sometimes mixed with the raw stock, but we will consider that only good sliver waste is to be mixed with the raw stock. Large mixings are made by hand, generally enough to last a week or longer if the mixing bin is large enough. Mixing is done in the same manner as in the case of finer grades of cotton, making as uniform a mixing as possible, so that all the bales of cotton used will be distributed throughout the mixing. For this class of goods an opener and three processes of picking are used. The speed of the breaker picker, which generally has three blades and is of a rigid type, is 1,550 revolutions per minute. The total weight of the lap at the front is 40 pounds or a 16-ounce lap. These laps are doubled four into one at the intermediate picker. This picker is provided with a two-bladed, rigid type of beater, the speed of which is 1,550 revolutions per minute. The total weight of the lap at the front is 39 pounds or a 14-ounce lap. The laps from the intermediate picker are put up at the finisher picker and doubled four into one. This picker is also provided with a two-bladed beater of a rigid type, the speed of which is 1,500 revolutions per minute. Great care should be taken to see that the cotton mixing is free from all foreign substances, for, if the beaters should strike any hard substances while going at this rate of speed, a spark is sure to be struck, which may cause considerable damage. The total weight of the laps at the finisher picker is 38 pounds, or a 14-ounce lap. A variation of 10 ounces either side of the standard weight is allowed for this class of goods; all laps varying more than this are run through the finisher picker again.

THE CARD.

The laps are put up at the card, which is covered with a coarse wire fillet on doffer, flats and cylinder, the wire on the cylinder being gauged coarser than that used for the doffer and top flats. The draft of the card should not exceed 85 and the speed of the flats should be one complete revolution in 60 minutes on a 110 top flat card. The cards should be stripped four times a day and ground once a month. For this class of work look out for the doffer comb to see that it

is set right and is making the correct number of vibrations to clean the doffer. The production of the card is 900 pounds or even 975 pounds for a week of 60 hours with a 70-grain sliver. The sliver is put through two processes of drawing frames.

THE DRAWING FRAMES

for this class of work are generally, although not always, equipped with metallic top rolls. Keep the flutes cleaned and the rolls well oiled. If leather top rolls are used, keep them well varnished, using a little heavier varnish than the recipe given in the article on long cloth. The weight of the sliver at the finisher drawing is 75 grains per yard. The doublings at the drawings are 8 into 1. This sliver is put through the slubber and made into .40 hank roving. This is then put through two processes of fly frames. At the first it is made into 1.00 hank roving and at the second 2.50 hank. Look out to see that the full bobbins are properly shaped and that the frames are changing right, so that the roving will not run over or under, as this will make a great deal of un necessary waste. The roving is taken to the

RING SPINNING ROOM

and spun into 22s warp yarn on a frame with a $2\frac{3}{4}$-inch traverse, 2-inch diameter ring, 7-inch traverse, 22.28 twist per inch and spindle speed of 9,500 revolutions per minute. This yarn is spooled and warped and these beams put up behind a slasher and sized and run on a beam at the front, on which the required number of ends are run. The filling yarn is spun into 26s on a frame having $2\frac{3}{4}$-inch gauge, $1\frac{3}{8}$-inch diameter ring, 6-inch traverse, 17.84 twist per inch (3.25 x square root of count) and a spindle speed of 8,000 revolutions per minute.

Dyeing Particulars.

The goods are piece dyed on the jigs or padding machines with one-dip colors.

BLACK.

5 per cent oxydiamine black AK.; 30 per cent Glauber's salt; 3 per cent sal soda.

Navy blues are also dyed in the same manner. The goods are very heavily starched with dextrine or animal glues of various kinds. The goods are run through a starch mangle, or starched by hand in a tub, and dried on a tenter frame. The starching process is repeated until a sufficient stiffness is obtained.

STARCH SOLUTION.

1 gallon water, 10 ounces dextrine, mixed cold and boiled for one hour. The addition of a little color, to color the starch, is sometimes required.

INDIGO PRINTS

Indigo print cloth is one of the standard types of cotton fabrics that are run with more or less success all the time, no matter what the trend of fashion or style may be.

An indigo print is distinguished from a regular print by having a printed figure, of any desirable type or design, on a solid indigo blue ground, the latter varying in depth of shade, according to requirements, whereas the ground of an ordinary print cloth pattern is white or a light color.

An indigo print pattern is obtained by one of

THREE METHODS:

indigo blotch printing, indigo discharge printing or indigo resist printing.

The basis of an indigo print may be any of the many types of plain cotton fabrics, according to weight and fineness desired, although what is known as a standard print cloth is generally used.

A "STANDARD PRINT"

is supposed to be constructed as follows: 28s warp, 36s filling, 28 inches wide, 64 ends and 64 picks per inch, 7 yards per pound.

28 inches x 64 ends per inch equals 1,792 ends in the warp, not allowing extras for selvages.

As a matter of fact, a great many so-called standard prints made in Fall River, the center of the print cloth industry, contain only 1,720 ends in the warp and 62 picks per inch in the filling.

In New Bedford print cloths are made from yarns two numbers finer than the above, being made of 30s warp and 38s filling. There are 1,790 ends in the warp and 62 or 63 picks per inch in the filling.

Another print cloth made in Fall River is 28 inches wide and contains 28s warp, 32s filling, 64 x 64 (shy). The weight is 6.44 yards per pound.

Although 28 inches is the usual width of these goods, they are also made in

OTHER WIDTHS,

generally wider. A certain wide Fall River print is constructed as follows: 34s warp, 36s filling, 46 inches wide, 56 ends and 52 picks per inch, 5.4 yards per pound.

On account of the large number of standard print fabrics used, by far the largest quantity of any type of cotton fabric made, many mills are run on these goods entirely.

THE LOOM REQUIRED

for weaving print cloths is of the ordinary plain 2-harness cam type. From a general consideration of the subject it would appear that the automatic looms would be the most economical to use.

With a plain loom the drawing-in and reeding plans are similar to those previously explained when considering other plain weave goods—skip shaft, draw on two twine harnesses, which is equal to 4 wire heddle harnesses, reed 2 ends per dent; selvage end, double.

In consequence of the colors or design of a print cloth being the principal salable features of the cloth, and those that appear to the eye the most readily, more attention is paid to quantity than quality when weaving them, the idea being that the printing and finishing processes will obliterate, or at least reduce, any cloth structural defects that may be made in the loom. Cloth defects are allowed to pass for prints that would not be allowed, only as second quality goods, to be finished by any of the other cotton finishing processes.

Carding and Spinning Particulars.

The mills which make yarn used for print cloth comprise the larger percentage of all the mills and would belong to the first division of mills, as given in a previous article. While the equipment of machinery is about the same in all mills making yarns for print cloth, still they differ in a great many cases as to the number of processes used. For example, one mill uses two processes of drawing and an extra process of fly frames; another may use a railway head and cut out one process of drawing, some mills using this machine before the drawing frame and some after. Some mills may only use two processes of pickers and an opener, whereas other mills use three processes.

ANOTHER FEATURE

about mills making print cloth yarns is that there is very little if any changing, according to the usual custom; as one overseer puts it, one set of gears is nailed on when the machine is started and left on until worn out, when another set of the same number of teeth is substituted for the old ones. In this article it will be the general machines and number of processes which will be given, for carding and spinning the standard print yarns, 28s warp and 36s filling. First comes the mixing, which may be done either by hand or by machine (bale breaker). The usual methods that have been explained in previous articles may be followed. Next the sliver waste from the different processes up to the slubber is mixed in at the bins or is sometimes placed in the hopper of the feeder and fed to it a little at a time along with the raw stock.

PICKERS.

After passing the opener the cotton is put through three processes of pickers, the beaters used on all three being generally the two-bladed, rigid type. The speed of these beaters at the different processes is as follows: Breaker, 1,500 revolutions per minute; intermediate and finishers, 1,450 revolutions per minute. The beats per inch at the finisher picker should be 40 to 43 for this staple cotton. The total weight of the laps is as follows: Breaker, 40 pounds or a 16-ounce lap; intermediate, 38 pounds or a 10-ounce

lap; finisher, 39 pounds or a 14½-ounce lap.

A variation from the total standard weight of the lap of half a pound either side is allowed. All laps weighing more or less are run through the finisher picker again. The doublings at the last two processes are 4 into 1. Mix cut-roving waste at finisher process.

THE CARDS

are set for coarse work, and while there are still many of the old-style American cards in use, for this article the newer card or the English card is much used, particulars of which will be given. The speed of the cylinder is 160 to 165 revolutions per minute; the licker-in, 350 revolutions per minute. The feed plate should be set to the licker-in one-eighth inch longer than the staple of the cotton, i. e., from bite of feed roll to licker-in teeth, and the feed plate should have a fairly pointed nose. The licker-in should be set with a 10-1,000ths inch gauge from cylinder wire. The back side of cylinder screen should be set 1-32d of an inch away from cylinder wire, directly underneath (in center), with a 28-1,000ths inch gauge and at the front one-quarter inch away from cylinder wire. The doffer should be set to the cylinder loose to a 5-1,000ths inch gauge; the doffer comb set with a 12-1,000ths inch gauge from doffer wire; the top flats to cylinder wire with a 10-1,000ths inch gauge and the back and front knife plates should be set the same as for leno cotton fabrics. The top flats make one complete revolution every 45 minutes. Strip three times a day and grind as before stated. The production for a week of 60 hours is 750 to 850 pounds. The weight of the sliver is 65 grains per yard. This sliver is next put through three processes of

DRAWING FRAMES,

the speed of the front roll being 400 revolutions per minute. Use either metallic or leather-covered top rolls. The advantages of both kinds have been given previously. The weight per yard of the drawing is 70 grains. The doublings at each process are 6 into 1. At the slubber the drawing sliver is made into .55 hank roving. The top rolls for this staple of cotton are not generally varnished. The slubber roving is next put through two processes of fly frames. At the different processes the hank roving is as follows: First, 2 hank; and second 7 hank for the warp yarn. The different processes upto the last fly frame for making 36s filling yarn are the same. Here the roving is spun into 8.50 hank. The yarn is then taken to

THE SPINNING ROOM

and made into 28s warp yarn on a frame with a 6½-inch traverse, 2¾-inch gauge, 1¾-inch diameter ring, 25.13 twist per inch, and 9,700 revolutions per minute of spindle. This yarn is spooled and warped and then put through a slasher. A

GOOD SLASHER MIXING

to use, if prints are to be woven on a common loom, is as follows: Water, 100 gallons; cornstarch, 50 pounds; tallow, 3 pounds; turpentine, 1 gill; boil 30 minutes. If woven on an automatic loom, use the following size: Water, 100 gallons; potato starch, 50 pounds; tallow, 3 pounds; turpentine, 1 gill; and boil 30 minutes. The roving for filling yarn may be either mule or frame spun. It is the general custom to have it ring spun in mills built lately. For this count of yarn use a frame with a 5½-inch traverse, 1⅝-inch diameter ring, 22.50 twist per inch, 8,900 revolutions per minute of spindle. This yarn, after being conditioned, is ready for use.

Dyeing Particulars.

The pieces are first bleached to get a good white, and then dyed in the continuous vat.

THE HYDROSULPHITE VAT.

The water is corrected by the addition of one quart of hydrosulphite to every 250 gallons of water. A stock liquor is made up in a barrel:

Fifty pounds synthetic indigo paste: 2½ gallons warm water; 3¾ gallons caustic soda, 76 degrees Tw., and stirred; temperature is raised to 105 degrees F., and 8 gallons of hydrosulphite added. The temperature is kept

at about 105 degrees F. for two hours. If the solution is not clear yellow, a further addition of one gallon of hydrosulphite is made. The vat is made up from the stock liquor and the pieces are passed through a sufficient number of times until the required shade is obtained.

The pieces are washed and dried and printed with a discharge paste.

WHITE DISCHARGE.

Four and one-half pounds bichromate of potash; 9 pints hot water; 1½ pounds soda calc, then 6½ pounds No. 11 gum; 5 pints water; heated to 140 degrees F., cooled and strained.

COLORED DISCHARGE.

Eight pounds discharge pigment; 10 pounds discharge thickening; 7½ pounds tragacanth, 8 ounces to gallon.

DISCHARGE THICKENING.

Eight pounds tragacanth, 8 ounces to gallon; 2½ pounds bichromate potash; 3¼ pints hot water; after dissolving add 20 ounces ammonia, 25 per cent; when cold add 1 gallon blood albumen, 8 pounds to gallon; after printing and drying, the material is passed through the following acid bath at 140 degrees F.; 4 pounds sulphuric acid, 168 degrees Tw., 4 pounds oxalic acid; 10 gallons water. The goods should be immediately well washed and dried.

LENO COTTON FABRICS

Leno fabrics constitute a division of textile fabrics characterized by particular warp threads crossing over one or more warp threads, instead of lying parallel to one another as in ordinary or plain weaving.

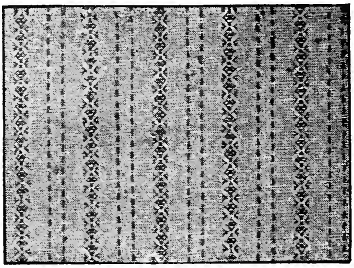
These fabrics possess two distinct sets of warp threads, the regular or ground warp and the douping warp or warp that crosses over the ground warp and forms the ornamental feature that characterizes the fabric.

Leno fabrics are woven upon a system quite apart from ordinary or plain weaving.

THE DIFFERENCE

lies chiefly in the fact that two sets of harnesses are required to operate the warp, the ground harness and the doup harness set.

The ground harness is the same as in ordinary weaving: the doup harness set consists of two harness frames, if string doup is used, known as the



standard and skeleton harness. When wire douping heddles are used, it requires three harness frames. We will for convenience deal with the string doup; this douping heddle is but a half heddle, so to speak. This half heddle is usually fastened at the bot-

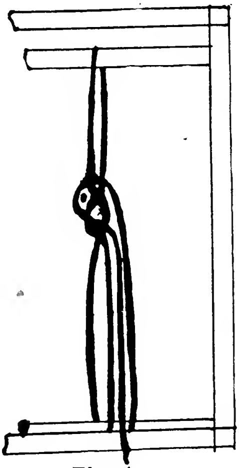
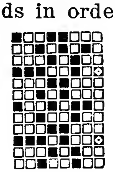


Fig. 1.

tom of the skeleton harness frame and connected with the stand and harness heddle by passing through the upper opening of the standard heddle, then through the eye of the standard heddle, then fastened at the bottom of the skeleton harness frame,

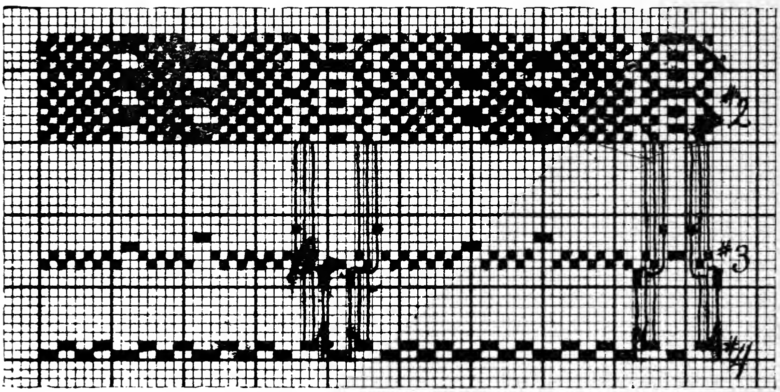
(See Fig. 1.) The secret of leno weaving will be readily understood if it is borne in mind that it consists of but two movements of the standard and douping heddles; these two movements are that if the standard and doup heddles are raised at the same time, the douping thread will be on one side of the ground warp threads, that is, it will cross under the ground threads; if, however, only the doup heddles are raised, the douping thread will remain in its normal position; that is, it will not cross under the ground threads. We must, however, bear in mind that in no case can the standard heddle be raised without also raising the doup heddle; when the standard and doup are raised together, we must also slacken or ease up on the doup warp threads in order to allow them to cross under the ground warp threads. This is done by means of a slackener or easing rod. This rod is similar to what is known as the whip roller in ordinary weaving. The doup threads pass under this rod into the eye of the doup; this rod is so arranged that it will let up or relieve all tension from doup threads by moving toward the loom. When doup threads are required to cross under ground warp threads the easing up of the doup threads must be indicated on chain draft. (See Fig. 5.)



▣ Slackener

Fig. 5.

Fig. 3 shows drawing-in plan. Fig. 4 reeding plan. All leno fabrics have special reeding plans; the reed is sometimes plucked, that is, a wire taken out of reed, so as not to overcrowd the threads. This is usually done when doup threads cross under six or more ground threads; the doup thread must be in same dent with the ground threads under which it crosses.



ANALYSIS.

1,400 reed special denting; 70 picks per inch; 38 inches in reed. Finished 36 inches.

WARP.

9 white.
2 medium blue.
6 white.
2 medium blue.
9 white.
2 dark blue.
1 white—2-ply.
2 dark blue.
1 white—2-ply.
2 dark blue.

36

As the warp layout is on 36 ends, the cloth contains two repeats of the same to one repeat of the weave.

Draw the 2-ply yarn from the top beam.

FILLING.

20 white 1-50s.

Pins.		Ends.
559	Black	48 1-40s.
233	Dark blue	20 1-40s.
56	Black	4 2-40s.

848 Pins, including selvages. Selvages 2-40s black.

Take-up during weaving ground warp 10 per cent.

Take-up during weaving doup warp 65 per cent. The take-up as noted upon this fabric on the leno yarn is about 65 per cent, but this amount will vary widely according to the fabric being produced. If the crossing or leno thread moves over a large number of ground threads and does it continually, the take-up is very large, whereas if it moves over only a few ground threads and does it intermittently, the take-up will not be so great. In a good many instances the take-up on an ordinary leno stripe is approximately 30 per cent.

LOOM REQUIRED.

These fabrics are usually woven on a dobby loom, the speed of which is from 120 to 145 picks per minute; a higher speeded loom usually causes considerable trouble with the doup warp.

The loom must necessarily carry two warp beams, ground warp and doup warp beams. Great care should be given to the setting of the harnesses, as they should be perfectly even and form a perfect shed when in operation.

FINISHING.

These fabrics are principally used for shirts and shirtwaistings. This requires that the patterns be not too large and that the warp stripe be more prominent than the filling stripe when fabric is made with filling stripe. There are a good many fabrics with leno stripes produced from bleached and dyed yarns, but there are probably more fabrics containing leno work, which are made from grey yarns and then either piece-dyed, printed, or sold in the white state. It is much more satisfactory to make leno fabrics from grey yarns than it is from bleached or dyed yarns, because yarns when grey are stronger and strength is essential to good production in leno work. Many grey shirting fabrics are decorated with leno stripes. In addition there are many leno fabrics made, wherein silk is used to a certain extent and which are woven with grey yarns and then dyed or piece bleached. After the fabric leaves the loom it is boiled off, then given a light sizing, pressed, then made up into rolls, after which it is ready for the merchant.

Carding and Spinning Particulars.

Leno fabrics, like all fabrics having a trade name covering a certain class of goods, are made up of various counts of yarn and of course the methods used in making the different counts vary as to the processes used, also the kind and staple of cotton and the speed and setting of the different parts of the machines. A great many times changing the speed or setting of one part of a machine may improve the unevenness of the yarn or roving, or, if made at the picker, stop licking, so that it is very hard or almost impossible to give a hard and fast rule of speed or settings for the machines that will cover the whole of leno fabrics. The particulars which are given may be taken

AS A FOUNDATION

from which to work and a little variation one way or the other only will be needed. For an example of leno yarns, we will consider the fabric to be made up of 1-40s and 2-40s warp and 1-50s filling yarns. For these counts of yarn the equipment of the second division of mills will be needed. The cotton generally used is Allen seed or peeler (American cotton) of 1¼-inch staple. Some mills comb both warp and filling yarns, while other mills comb only the filling yarns. In this article we will consider that only the filling yarn is to be combed, although, if both are combed, the particulars given below may be used. The mixing is made as has been previously described, it being pointed out that the use of a bale breaker in connection with a blower will help the cotton to a great extent. An opener and

TWO PROCESSES OF PICKING

are used. The sliver waste from all the machines up to the slubber is mixed in at the bins. At the opener use the particulars that have been given

in previous articles. The breaker picker has a two-bladed, rigid type of beater, and the speed of the beater is 1,450 revolutions per minute. Care should be taken to clean all seeds, etc., from under the bars at regular and frequent intervals. The total weight of the lap at the front of this picker is 38 pounds, or a 13-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. The speed of the beater of this machine is 1,450 revolutions per minute; the fan speed being 1,100 revolutions per minute; the driving shaft of the picker making 375 revolutions per minute. Cut-roving waste is mixed in at the finisher picker in the proportion of 1 lap cut waste to 3 laps raw stock, the cut roving having been treated as described in previous articles. The total weight of the lap at the front end of the finisher picker should be 35 pounds or a 12½-ounce lap. The laps are put up

AT THE CARD,

the draft of which should not be less than 100. The wire fillet generally used for this class of goods is 34s on cylinder and 35s on doffer and top flats. Set feed plate from licker-in with 20-1,000ths of an inch gauge; licker knives from licker-in 12-1,000ths of an inch; cylinder under screen from cylinder 22-1,000ths inch in center and one-quarter of an inch at each end of screen; top flats from cylinder, with a 12-1,000ths inch gauge, licker-in from cylinder with a 1-1,000ths of an inch gauge, doffer from cylinder with 7-1,000ths of an inch gauge. Always set to high places. Set the back edge of the back plate knife 17-1,000ths of an inch from the cylinder. The front plate knife has its upper edge adjustable in order that the amount of stripping to be taken from the flats may be regulated. Setting this plate closer to cylinder

MAKES LIGHTER STRIPPING,

and the farther away it is set, the heavier stripping it produces. The lower edge of this plate is set to a 17-1,000ths of an inch gauge. Grind and strip card as previously described. The top flats should make one complete revolution every 45 minutes. The percentage of waste taken out at the card for this class of goods should be about 4½ to 4¾. The production for a week of 60 hours is 700 pounds with a 65 grain sliver. Use a large diameter doffer. The sliver for the filling yarn is taken to the sliver lap machine and doubled 14 into 1 for an 8¾-inch lap or 20 into 1 for a 10-inch lap. The weight of the lap at the front is 300 grains. These laps are put up at the ribbon lap machine and doubled 6 into 1. The weight of a lap at the front end of a ribbon lap machine is 260 grains per yard for an 8¾-inch lap. Get weight for a 10-inch lap by proportion. Size both ribbon and sliver lap machines once a day.

THE DOUBLINGS

at the comber depend on the number of heads of the machine; recent machines are generally provided with eight heads with a 10-inch lap. The speed of the comber for this class of stock is 85 nips per minute for old machines and 100 nips for those of recent construction. Varnish rolls once a week, using one of the recipes given in previous articles; in sticky or dog-day weather use a little ground charcoal and gum arabic dissolved in a teaspoonful of vinegar. This swells to five times its bulk. Take out 18 per cent waste. After passing the combers, the sliver is put through two processes of drawing, being doubled 6 into 1. The speed of the front roll at each process is 350 revolutions per minute. The weight of the sliver at the finisher drawing is 70 grains per yard. The card sliver for the warp yarn is put through three processes of drawing, the speed of the front roll being 380 revolutions per minute. The weight of this sliver is also 70 grains per yard. The sliver is next put up at the slubber and made into .55 hank roving. From here it is put through three processes of

FLY FRAMES,

the hank roving at each process being as follows: First, intermediate, 1.50; second, 4, and jack, 12. Keep your leather rolls in good condition and see that all parts of machine are well oiled and that top and bottom rolls are prop-

erly set, which for this length of staple should be for fly frames as follows: Front roll to middle, 1⅜ inches; middle roll to back, 1½ inches. From here the roving is taken to the spinning room, although some prefer mule spun yarn. There is a great difference in the opinion of mill men as to the advantages and disadvantages of both systems, one mill building with no mules and another including them in its equipment. We will consider both yarns to be

FRAME SPUN.

For a warp frame spinning 40s use a frame having a 2¾-inch gauge, 1⅝-inch diameter ring, 6½-inch traverse, 28.46 twist per inch, 10,000 revolutions per minute of spindles. The 1-40s warp yarn is spooled, warped and put through the slasher, a good mixing for which has been previously given. The 2-40s yarn is put through a twisting frame and spooled. Enough spools are put up at the warper and the ends, after which run on to a specially constructed beam.

For the filling yarn 1-50s, use a ring frame having a 2¾-inch gauge, 1¼-inch diameter ring, 5½-inch traverse, 26.52 twist and spindle speed of 8,200 revolutions per minute. This yarn is conditioned and then is ready to be woven.

Dyeing Particulars for Yarn.

BLACK.

Ten per cent immedial black N. N.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent Glauber's.

LIGHT BLUE.

Three per cent diamine sky blue F. F.; 3 per cent sal soda; 30 per cent Glauber's salt.

LIGHT SLATE.

One per cent diamine black BH.; 1 ounce diamine fast yellow A.; 1 per cent sal soda; 20 per cent Glauber's.

LIGHT BROWN.

One-half per cent naphtamine brown 6 B.; 1 per cent naphtamine yellow N. N.; 1 per cent sal soda; 30 per cent Glauber's.

MEDIUM GREEN.

Six per cent thion green G.; 2 per cent thion yellow G.; 8 per cent sulphide sodium; 3 per cent soda ash; 30 per cent Glauber's.

MEDIUM BROWN.

Three per cent tetrazo dark brown; 1 per cent sal soda; 20 per cent salt.

MEDIUM SLATE.

One per cent tetrazo black G.; 1 per cent sal soda; 25 per cent salt.

WINE.

Three per cent tetrazo Corinth; 1 per cent sal soda; 25 per cent salt.

RED.

Three per cent benzo fast red 4 B.; 1 per cent sal soda; 25 per cent Glauber's.

DARK GREEN.

Seven per cent thio green B.; 8 per cent sulphide soda; 3 per cent soda ash; 30 per cent Glauber's salt.

ECRU.

One per cent thion brown G.; 1 per cent sulphide soda; 2 per cent soda ash; 20 per cent Glauber's salt.

FAWN BROWN.

One per cent diamine fast yellow A.; 2 per cent diamine brown M.; 1 per cent sal soda; 20 per cent salt.

NAVY BLUE.

Five per cent diamine dark blue B.; 2 per cent sal soda; 30 per cent Glauber's salt.

BEDSPREADS — Crochet Quilts

Bedspreads, also termed bed quilts, coverlets and counterpanes, are, as the names imply, used as coverings for bed clothing.

Being primarily decorative fabrics, most of them show elaborate jacquard designs of a type peculiar to this class of fabric, the use to which they are subjected necessitating a design of a large, bold character that is complete in itself in each quilt.

Quilts are of various sizes, ranging from crib quilts, 28x63 inches, to large quilts, 92x108 inches.

For metal beds the quilts are sometimes cut at the four corners so they will hang better and make a neater appearance.

Being a type of fabric of universal use in civilized countries, for all classes of people, quilts are necessarily made in widely varying qualities. They are also made in varying single and compound structures of cloth, and in varying types of designs.

THREE PRINCIPAL TYPES.

Three of the principal types of structures are seen in quilts known as crochet, Marseilles and satin. The first is a single fabric, where all yarns used show on one side or the other.

The second is a compound fabric, in

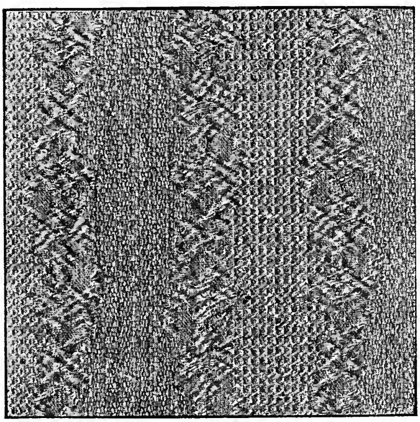


Fig. 1.

which the extra yarns are generally used for the purpose of adding weight and at the same time producing an embossed pattern on the face.

The third is a double cloth, reversible, with some types of designs in which each of the single cloths alternate from one side of the quilt to the other, according to the pattern required.

These three types will be considered in the above order.

It may be mentioned here that there are other names of quilts, as Toilet, Albany, Mitcheline, Duree, Grecian, Embroidery, Tapestry, Kensington, Alhambra and Honeycomb, but these may be included in one or another of the three principal types mentioned.

CROCHET QUILTS.

The term crochet quilt does not mean that said fabric is crocheted with needles, but refers to the simplest type of woven single cloth quilt made with medium or fine counts of yarns. Honeycomb and Alhambra quilts are of the same class, differing principally in the type of design used.

This class of quilt, for full size quilts, shows variations in size from about 68x82 inches to 80x90 inches, and in weight from about one pound, 12 ounces to three pounds, 9 ounces, per quilt.

THE ANALYSIS

of an unbleached crochet crib quilt shows the following data: Width, 31 inches; 84 ends and 72 picks per inch; 24s warp, 12s soft twisted filling. The warp contains 2,600 ends and is reeded three ends per dent in a 26-dent reed. The cloth will finish about 28 inches wide.

By reference to Fig. 1, it may be seen that the pattern is a stripe composed of four sections in each repeat, as follows: First, a section of honeycomb effect, formed by weave Fig. 2, on 6x6; second, a continuous floral effect, filling flush weaves; third, a crepe effect, formed by weave Fig. 3 on 32x12; fourth, like the second section, but dropped 78 picks, one-half the number in each repeat.

There are a little more than 12 repeats in the entire width. The selvages are each one-half inch wide, reeded the same as the ground, and show an angled twill weave effect.

The length of the pattern filling way is 2 3-16ths inches and requires 156 picks for a repeat.

As there are 200 ends in a repeat of the design, a 400-hook jacquard might be used, each pick of the pattern being read twice on each card.

THE LOOM REQUIRED

for this type of fabric is of medium weight. The pattern being small, a small jacquard head of the ordinary rise and drop type, or, if the weave is not required to be changed to form the headings of the quilt, a double action head may be used.

For the sample shown, if required to have headings at both ends to complete the quilt, differing in weave from the ground, what is termed a double or single acting automatic auxiliary cylinder jacquard would be the most economical to use.

If the ground weave was required to be repeated 25 times between headings, an ordinary jacquard attachment

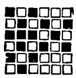


Fig. 2.

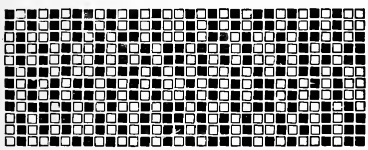


Fig. 3.

would require 25x156 picks in repeat, equalling 3,900 cards for the ground, whereas with the auxiliary cylinder machine 156 cards only would be required for this same section.

For larger patterns, the capacity of the jacquard would be required to correspond, i. e., with more than 400 ends in a repeat.

FINISHING.

The goods are generally woven grey from unbleached yarn, and are bleached and finished after they leave the loom. A quilt will shrink in width about 10 per cent from the gray to the finished state, and increase about 1 per cent in length.

After bleaching, starching and bluing, they are cut, hemmed or fringed as desired, inspected, rolled or folded, tagged and papered.

It is not advisable to leave finished quilts unpapered for any length of time if in the same building as the bleach house, because the fumes from the bleaching liquors take out the bluing in a short time. If this is done after the quilt is folded, the bluing is taken from the outer layers only, and uneven, poor-looking quilts result.

Carding and Spinning Particulars.

The yarns of which bedspreads are composed are made in mills of the second division. There is one feature about the filling yarn which is not common to all fabrics, and that is, it is what is called soft twisted. The counts of yarn which make up the fabric to be described in this article are 24s warp and 12s filling.

THE WARP YARN

is made from 1-inch staple American cotton, while the filling yarn is made from a good grade of ⅞-inch staple American stock. The mixing is done in the usual manner, which has been described many times before, separate bins being used for the two staples. The good sliver waste from all machines up to the slubber is mixed in at the bins. This sliver should be spread over the entire mixture and not bunched in one place; it should also be broken into short lengths so that it will not be so apt to become tangled around the spikes of the hopper. This hopper should be kept full so as to feed an even amount of cotton to be struck off by the pin roller at the top of the lifting apron.

The raw stock for both warp and filling yarns is put through three processes of picking, the breaker picker being generally connected directly to the opener. Many different kinds of

BEATERS

are used by different mills, each claiming certain advantages over the other, but the style of beater in most general use throughout the mills is what is known as the two-bladed or armed rigid type of beater, although many mills use a three-bladed beater of the same style for the breaker picker. To sharpen the edge of this beater its side is planed. The speed of the beater used for the same stock and weight lap varies greatly in different mills and the speeds given below are the ones used in a mill making this class of goods. For the breaker picker the speed of the beater (two-bladed) is 1,500 revolutions per minute, for the intermediate, 1,450 revolutions per minute, and for the finisher 1,350 revolutions per minute. The total weight of the lap at the breaker is 40 pounds or a 16-

ounce lap, at the intermediate 37 pounds, or a 10-ounce lap, and at the finisher 39 pounds or a 14½-ounce lap. At the intermediate and finisher pickers the laps are doubled four into one. The draft of the finisher picker does not exceed three. At this picker it is customary to mix in the roving waste both cut and uncut. The roving waste that has not been cut from the bobbin consists of that which is made by the speeder tenders when they are putting in new sets of roving and taking off single and double. Speeder tenders should never be allowed to cut off roving; all bad work being sorted out, charged and given to them to fix. All marks should be made small and near the bobbin.

The laps from the picker are next put up

AT THE CARD,

the draft of which for this fabric should not exceed 100. The wire fillet used should be No. 33s for cylinder and 35s for doffer and top flats. The settings of the card should be the same as given for leno cotton fabrics, although some overseers use a little wider settings for this class of stock. The speed of the licker-in should be 375 revolutions per minute, cylinder 165 revolutions per minute, and the flats should make one complete revolution every 50 minutes. The card should be stripped, ground and cleaned. The weight per yard of the sliver at the front should be about 65 grains per yard, the production for a week of 60 hours being 750 pounds. This sliver is next put through three processes of

DRAWING FRAMES,

the doublings at each process being 6 into 1. For this class of goods metallic rolls may be used to great advantage. If leather top rolls are used, they should be varnished frequently and kept in good repair. See that all parts are working properly, especially those parts which coil the sliver into the cans, because if these are not working properly, the sliver cannot be run out at the next process without a great deal of breaking back of the sliver. Imperfect coiling of the sliver is a great many times caused by the cans themselves, they being out of true or having broken parts sticking out and coming in contact with part of the machine and stopping the can from turning. The only remedy for imperfect coiling is to run it over again.

The spread of the front roll of the drawing frame at each process is 375 to 400 revolutions per mniute. The

WEIGHT OF THE SLIVER

for warp yarn is 70 grains and for the filling yarn, 80 grains per yard. These slivers are put up to the slubber and made into .40 hank for the ⅞-inch stock and .60 hank for the 1-inch stock. The process of fly frames for the 1-inch stock and the hank roving made at each process are as follows: First, 2 hank, and second, 6. From here it is taken to the ring spinning room and made into 24s yarn on a frame having a 2¾-inch gauge of frame, 2-inch diameter ring, a 7-inch traverse, 23.27 twist per inch and a spindle speed of 9,600 revolutions per minute. The yarn is then spooled and put through a warper and these warps put up at the slasher, the required number of ends being run on a beam at the front.

The slubber roving for the filling yarn is put on the first intermediate fly frame and made into 1 and then into 2.5 hank at the next process, after which it is taken to the mule room and spun into 12s yarn with a twist per inch of 2.75.

After leaving the loom, quilts are first boiled for 10 hours with a

CAUSTIC SODA SOLUTION

at 4 degrees Tw., rinsed well with water and boiled again with a 4 degree Tw. caustic soda, 10 hours; rinsed well with water, soured with one-half degree Tw. oil vitriol, rinsed with water, chemicked with one-half degree Tw. chloride of lime solution, scoured with 1 degree Tw. oil of vitriol and rinsed two or three times with water. The goods are placed in the kiers, each piece separate, and handled very carefully throughout the whole operation.

BEDSPREADS—Marseilles Quilts

Marseilles quilts are characterized by large embossed effects, usually of elaborate floral or geometrical design, each pattern occupying an entire quilt.

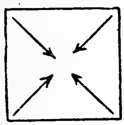


Fig 1

The general effect is similar to what would be formed by stitching a pattern on a fine plain cloth, which effect is made more prominent in the better grades of goods by weaving a coarse plain cloth at the back and inserting wadding between the face and back cloths. When wadding is used the stitching points form deep furrows, which indicate the pattern.

One of the principal types of designs used reverses from the center in both directions, warp way and filling way, as in Fig. 1.

When designing for this type it is necessary to make only one-quarter of the figuring design, the same occupying only one-sixth of the total number of ends in the warp, or one-half of the stitching ends. The jacquard tie-up is on the point or center draft principle, $\wedge$, which doubles the capacity of the machine as compared to a straight tie-up, and there is an attachment on the loom by which the cards are reversed when the center of the quilt is reached filling way.

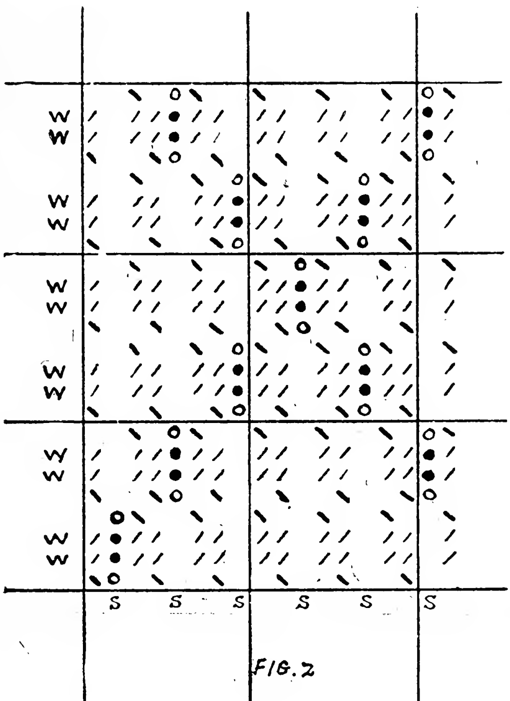


FIG. 2

When considering the plan for the card cutter only one-half of the stitching ends and one-half the back picks in each quilt are considered, i. e., when there are two face picks to one back pick.

There are two types of Marseilles weaves, known as ordinary Marseilles and fast-back Marseilles. The latter

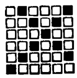


Fig. 3.

type is used for almost all but the lowest qualities of goods.

Design Fig. 2 illustrates the principle upon which an ordinary Marseilles weave is constructed, in which the

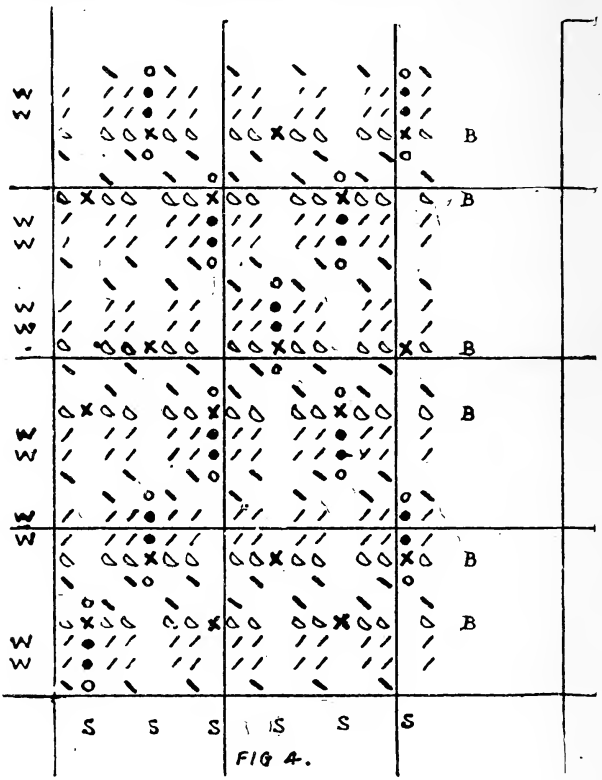


FIG 4.

wadding lies between the face cloth and the stitching, also termed binder, figuring, or back, ends. These ends when not required to be raised to form the pattern, remain at the back of the cloth and are not interlaced with the filling. On this account the distance, filling way, between the stitching points is necessarily limited.

In Fig. 2 the ends marked S are stitching ends, raised over the face cloth at O on the face picks and at ● on the wadding picks.

The picks marked W, shown in type / , indicate wadding, inserted for the purpose of adding weight and of forcing the face cloth up, or embossing it. When these picks are inserted, all the face ends are raised.

Fig. 3 shows the motif or order of stitching in Fig. 2.

FAST-BACK WEAVES.

A fast-back differs from an ordinary Marseilles weave in having the fine filling; besides interlacing with the face ends, it also interlaces with the stitching ends when the latter are at

the back between stitching points. In this way a double plain cloth is formed, either of which could be taken away and still leave a perfect single cloth.

In fast-back Marseilles quilts, both face and back weaves are plain, the pattern being formed by the stitching points.

In Fig. 4, which shows a fast-back weave completed to form the motif Fig. 3, ends S indicate stitching ends; W indicate wadding picks, and B indicate back picks.

Marks / show all face ends raised when wadding picks are inserted; stitching ends are all down on these same picks except where they are required to be brought through the face cloth to form a stitching point.

When the back picks are inserted, all face ends are raised, as indicated at *a*, and one-half of the stitching ends, as at x, forming a plain weave at the back.

The ends and picks not marked S, W or B form a plain weave on the face.

Marks O show where stitching ends are brought over the face cloth, each stitching point covering two face picks, to define the pattern.

A standard make of cloth made with suitable designs on the principle shown in Fig. 4 is as follows: Warp, 40s yarn for face, 20s for stitching, arranged 1 end of 40s, 1 of 20s and 1 of 40s; 80 face and 40 back ends per inch, 120 average sley.

Filling 60s yarn for face and back, 12s yarn for wadding, picked 1 pick of 60s, 2 of 12s, 4 of 60s, 2 of 12s, 1 of 60s, repeated; 200 picks per inch.

The reason why the picks are arranged as here shown in preference to arranging them 2 face, 2 wadding, 1 back, is to enable an even number of picks of one count of filling to be inserted before the shuttles are changed. This can be done on a loom having a single box at one end and a multiple box at the other.

When a pick and pick loom is used, which is in the majority of cases, 4 picks instead of 5 complete the round of filling, one pick of 6s taking the place of 2 of 12s for the wadding.

The yarns in both warp and filling are usually arranged 2 face to 1 back, making a fine effect on the face and a coarse one on the back; this in addition to the wadding picks.

Two warp beams are required, one of which, that containing the stitching yarn, is more heavily weighted than the other in order to pull down the

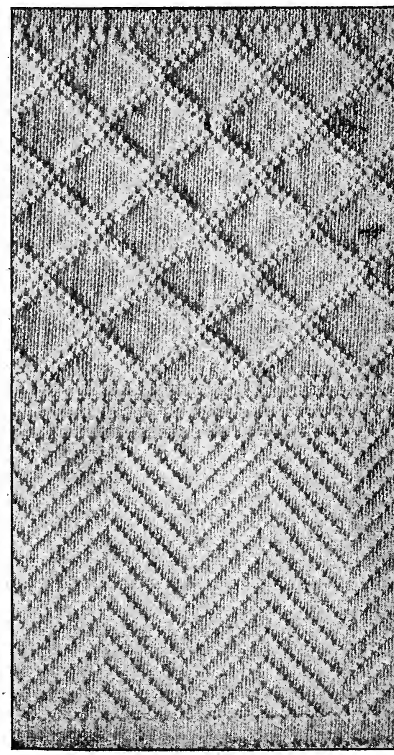


Fig. 5.

stitching points and make the embossed effect as prominent as possible. This warp may be of equal or of different counts from the face warp. It is usually of lower counts.

LOOM REQUIRED.

The patterns being large and elaborate, a jacquard head is of necessity used, although not of such a large capacity as would at first appear.

The cards for this head control the action of the stitching ends only.

An examination of Fig. 4 will show that only 2 ends are necessary tc complete the face weave, every alternate face end working similarly.

The face ends, two-thirds of the entire number, are worked most economically by harness shafts, generally placed at the rear of the comber board.

These shafts are worked from the head in a positive manner, independently of the pattern cards.

To weave a quilt like the one under consideration, say 90 inches wide, an 1,800 hook head would be required, tied up point draft.

The 20s warp would contain 3,600 ends, and the 40s warp 7,200 ends, making a total of 10,800 ends in the quilt.

On a pick and pick loom Fig. 4 could be woven with 8 instead of 10 picks in a repeat, the action being as follows: First pick, jacquard rises, carrying the hooks selected for stitching by pattern card; all face warp raised; wadding filling. Second pick, jacquard up; one-half of face warp up and the other half down; fine filling; face pick. Third pick, jacquard up; face ends reverse positions; fine filling; face pick. Fourth pick, jacquard drops and then rises again, carrying with it one-half every alternate one, of the stitching ends; all face warp raised; fine filling; back pick.

The fifth, sixth and seventh picks are a repetition of the first, second and third, with perhaps the exception that a fresh selection of stitching ends have been raised.

Eighth pick, jacquard drops, then raises the half of the stitching ends not raised, and leaves down the ends that were raised on the fourth pick; face ends all raised; fine filling; back pick.

The principal advantage claimed for this method over others is that the attachment for raising the stitching ends, one-half every fourth pick, dispenses with one-half of the number of cards ordinarily required.

Two other methods are used for actuating the stitching ends when back picks are inserted. First, by bringing jacquard cards, called plain cards, into play to work them; this method requires double the number of cards required for the same pattern.

Second, by using 2 comber boards, drawing the odd numbered ends through one and the even numbered ends through the other, and raising each board alternately every fourth pick.

When this plan is adopted knots are put on the harness cords immediately above the comber boards so that when the boards rise the cords and ends are also raised.

Light-weight Marseilles quilts are known as Toilet quilts. They vary in weight from about 2.5 pounds to 4 pounds per quilt.

Heavy-weight quilts vary from 3.5 pounds in narrow quilts to 6 pounds for wide goods.

In the lightest and cheapest grades of fabrics wadding picks are omitted, but when made on the fast-back principle the back filling is considerably coarser than the face filling.

The processes of finishing are somewhat similar to those explained in the article dealing with crochet quilts.

Carding and Spinning Particulars.

Marseilles quilts are of a better quality than the quilts described in the preceding article, but are made in the same division of mills. The quilts under description require four different sizes of yarn, which are as follows: 40s and 20s for warp and 60s and 12s for the filling. For 12s yarn use cotton of from ⅞ to 1 inch in staple; for the 20s and 40s use 1⅛ inch stock and for 60s 1¼ to 1⅜ inch stock, all American cotton. For the filling yarn a soft twist is used and it is generally mule spun. Mix raw stock by usual method, of course the different staples being mixed in separate bins. Hand mixing is generally used on this class of goods, but it would be

OF GREAT ADVANTAGE

to use a bale breaker or willow to prepare the cotton before it is fed to openers. All stocks are put through an opener and three processes of pick-

ing. The speed of the beater (rigid, two-bladed style) for all stock except the ⅞-inch is 1,500 revolutions per minute. For the short stock the speed should be increased so as to take out the extra amount of dirt which is always in short staple cotton. The total weight of the laps at the front for all staples should be 40 pounds or a 16-ounce lap. At the intermediate the speed of the beater is 1,450 revolutions per minute for all stocks, except the short stock, where speed should be increased. The total weight of lap at the front is 37 pounds or a 12-ounce lap for the finer yarns and a 10-ounce lap for the stocks for 12s and 20s yarn. These are put up at

THE FINISHER PICKER

and doubled 4 into 1. At this picker the cut roving is mixed in in proportions that have been described in previous articles. The speed of this beater varies from 1,400 to 1,500 revolutions per minute, according to the yarn being put through, the higher speed being used for the stock for the 12s yarn. This gives the stock for 20s, 40s and 60s about 42 beats or blows per inch. The total weight of the lap at the front is as follows: 35 pounds for the 60s and 40s yarns and 39 pounds for the 12s and 20s yarns, or a 12½-ounce lap for 1⅜-inch stock, and 14-ounce lap for the other stocks. A variation of one-half pound either side of standard is allowed for all the stock, except the ⅞-inch staple, for which a variation of 10 ounces either side of staple is allowed. Follow instructions about oiling, cleaning, etc., that have been given in previous articles.

THE CARDS

should be fitted up with 34s wire fillet for cylinder and 36s for top flats and doffer. The draft of the card should be as follows: 110 for 60s and 40s yarns and not over 100 for the shorter staples. Speed of licker-in is about 325 for long staple and 375 for ⅞-inch stock. The speed of the flats for the different stocks is as follows: 1 complete revolution in 40 minutes for 60s yarn, 50 minutes for 40s yarn, 55 minutes for 20s yarn and 60 minutes for 12s yarn. Strip cards three times a day, except for the ⅞-inch stock, when an extra stripping of both cylinder and doffer should be made, although some overseers strip only three times, while others strip the doffer only an extra time. Use same

SETTINGS

for card as were given in the last article except for the ⅞-inch stock, when those for indigo prints should be used. The production for a week of 60 hours should be as follows: 1,000 pounds for ⅞-inch stock, 800 pounds for the 20s yarn, 750 for 40s yarn and 700 pounds for 60s yarn. The weight of the sliver is 65 grains for all staples.

The cotton for 60s is combed and the instructions, weights, etc., given in the last article may be used for the 40s and 20s. The card sliver is put through three processes of picking and for the 12s only two processes are used. Either metallic or leather top rolls may be used. We should recommend metallic rolls for the coarser work.

The weight per yard at the finisher drawing should be 70 grains for all staples except the ⅞-inch, which should be 80 grains per yard. The speed of the front roll should be about 400 pounds for coarse work and 350 for finer staples.

THE DRAWING

is put up at the slubber and made into .60 hank for 20s, 40s and 60s yarns and .40 hank for 12s yarn. The roving for 60s and 40s yarns is put through three processes of fly frames and for 20s and 12s yarns two processes are used. The hank roving for each yarn and the hank roving at each process is as follows: For 60s yarn, first intermediate, 1.50; second, 4.50; and fine, 12.50 hank. For 40s yarn first intermediate, 1; second, 3; and fine, 8 hank. For 20s yarn, first intermediate, 1.50; second, 4. For 12s yarn, first intermediate 1, and second, 3 hank.

THE ROVING

for the filling yarns is generally mule spun, because a soft twist is put in, about 2.75 x square root of yarn being

used. For the warp yarn a ring frame is used. Of course if this fabric is made in a mill having only ring frames both yarns will have to be ring spun. The yarns for filling after being spun at the mule are all ready to be woven after being conditioned. For spinning 40s on a ring frame use a frame with 2¾-inch gauge, 1⅝-inch diameter of ring, 6½-inch length of traverse, 28.46 twist per inch and spindle speed of 10,000 revolutions per minute; for 20s use a frame with 2¾-inch gauge, 2 inches diameter of ring; 7 inches length of traverse, 21.24 twist per inch and spindle speed of 9,400 revolutions per minute. After passing the ring frame the yarn is spooled and warped and the 40s yarn is put through the slasher.

BEDSPREADS — Satin Quilts

Satin quilts, so called, are distinguished by having a fine, smooth ground, from which the pattern appears to stand up. This pattern is made with coarse filling interlaced with a comparatively fine warp. The latter is almost lost to view in the coarse filling, unless examined closely.

The coarse filling floats over the ground yarns to form the pattern, and under them when not required to form the pattern, being bound with binding yarns, so called, generally in plain cloth order. The binding warp is all down when the ground filling is inserted.

The ground yarns, warp and filling, are of medium counts.

Fig. 1 illustrates the effect.

The term satin is probably used on account of the fine appearance of the ground, and not from any reference to the weave, as both ground and figuring weaves are generally plain.

MINOR VARIATIONS

in weave have been made from time to time, and patents granted for them, with the result that these goods are now sold in the market under different names. In 1868 a patent was granted for this type of quilt, known then and now as Mitcheline, in which a bold figure is generally woven on a plain ground, the figure being plain, twill or satin as desired.

Other names now used for practically the same type of quilt are Duree, patent satin, embroidery and Kensington.

Although generally woven white, some

VERY GOOD EFFECTS

are obtained in satin quilts by using colored ends in stripe form for the ground, as in Fig. 2.

An analysis of the sample illustrated in Fig. 2 shows the following data: Ground warp, 30s; binding warp, 20s; ground filling, 30s; coarse filling, 3s.

All binding ends are white ends.

The ground warp yarns are arranged 3 white, 3 blue, alternately.

There are 69 ends per inch, 46 of 30s and 23 of 20s, arranged 2 of 30s and 1 of 20s alternately.

The warp yarns are usually arranged 2 ground, 1 binder, although other arrangements are used. The filling is arranged 2 of ground and 2 of coarse, or 1 pick of each alternately.

The principle of construction of satin quilt weaves is illustrated in Figs. 2, 3 and 4.

The effect seen in Fig. 2 is like the motive Fig. 3, each end of which represents 18 ends in the cloth; each pick in Fig. 3 corresponds to 8 picks in the cloth.

The complete weave is illustrated in Fig. 4, where ends B, every third end, are binding ends; picks C are coarse picks. Solid squares show where these ends and picks interlace to form a plain weave. Marks x show where the ground ends and ground picks weave plain.

Marks . (dots) show where the ground warp is raised when coarse filling is inserted, leaving the latter at the back as not being required to form the pattern.

On the same picks in which these marks occur it may be noticed that some of the ground ends, indicated by = =, are down, allowing the coarse filling to float over them. It is at

these places that the latter forms the figure. In Fig. 4 these marks indicate filling. All other marks indicate warp.

Two beams are required. The ground beam is more heavily weighted than the other, the idea being to allow the coarse filling to show as prominently as possible, and this filling passing first to one side of the cloth and then the other, and lying practically flat, not being bent out of a straight line by the warp, necessitates the binder warp being held somewhat slack.

The goods vary in weight from about 3 to 5 pounds.

LOOM REQUIRED.

Satin quilts, although containing fewer ends than Marseilles quilts, require a much larger number of hooks, usually from 2,400 to 3,600.

Sometimes it is necessary to use two jacquard heads over one loom. The loom part itself is somewhat similar for both types of quilts. Two shuttles are used, one for each count of filling, picking 1 and 1 or 2 and 2 alternately as required.

One concern builds a jacquard head designed especially for weaving satin quilts. It is built straight-lift, or rise-and-drop as desired.

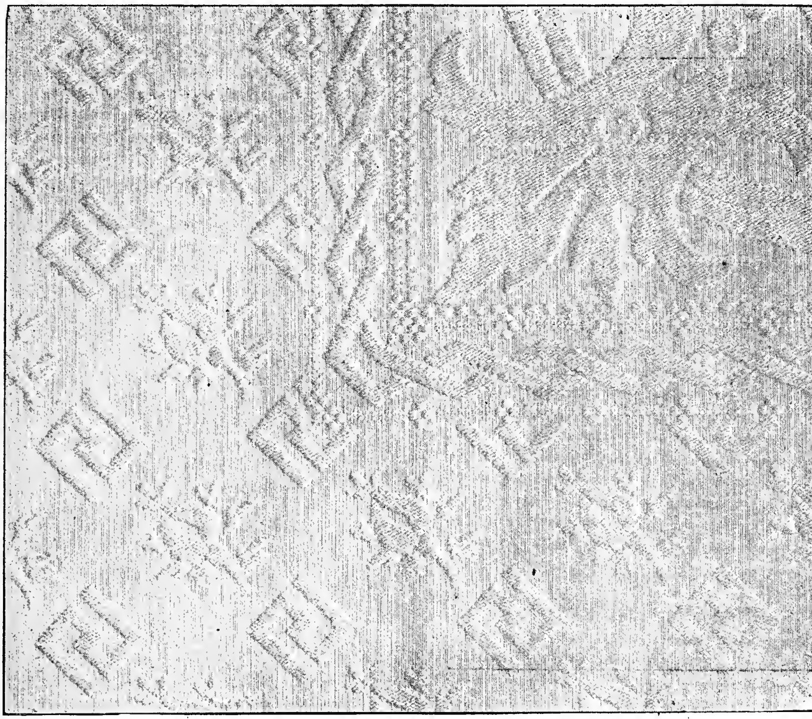


Fig. 1.

With this machine the ground picks are woven plain, satin, or twill as desired, without the action of the cards or cylinder. This saves labor in making the design and cutting the cards because in making a design the figure only need be dealt with. The binder ends, working plain all the

time with the coarse picks, may be drawn through harness shafts and worked from the head, irrespective of the cards, as in Marseilles weaving.

The cards actually need actuate only the ground ends on the coarse picks, the remainder of the ends and picks being actuated in a positive manner by the head.

FINISHING.

The finishing of white quilts is about the same for all types, with the

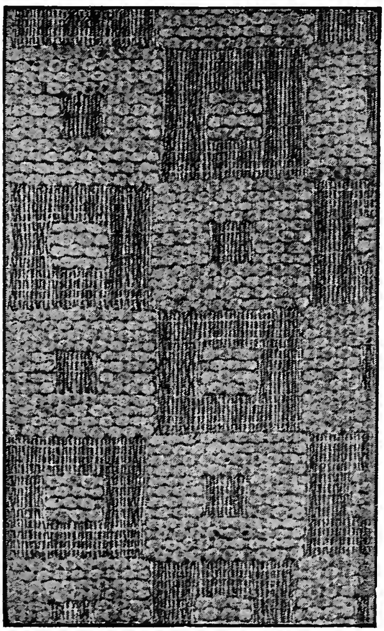


Fig. 2.

exception that some need more blue and starch than others. Briefly, they are bleached, washed to remove the acid, run through blue mangle, starched, dried, cut, hemmed, or fringed, inspected, folded, ticketed, bundled and packed.

In some mills it is the custom to weave the number of the loom on each quilt as it is being woven, so that if any defect shows up in any of the subsequent processes it can be readily traced to its source.

Carding and Spinning Particulars.

Satin quilts are made in the same division of mills as the fabric described in the last article. The cotton used is similar. The make-up of satin

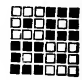


Fig. 3.

quilts differs in different mills and even in the same mill different grades of this fabric are made. The quilt that has been analyzed for this article is made up of the following counts of yarns: 30s and 20s warp yarn and 3s and 30s filling yarn. As stated above, all the yarns except the 3s would be made up of cotton of $1\frac{1}{16}$ to $1\frac{1}{8}$-inch staple. The 3s would be made from a shorter staple, say $\frac{3}{4}$ to $\frac{7}{8}$ inch, and mixed with waste, as will be shown later.

THE MIXING.

The cotton for the warp and filling, except the 3s, is mixed in the usual manner and after being allowed to stand as long as possible (in order that it may dry out), the good waste from the machines up to the slubber, which is collected at regular intervals, is mixed in at this point, care being used to break up sliver waste into small lengths and to spread the sliver throughout the entire mixing, so that it will not all be fed to the feeder at once. In some mills a very small percentage of comber waste is mixed in at this point, but it is not the general custom to use a mixture of this kind. For the 3s yarn the mixing is made up of a certain per cent of waste, the exact percentage depending upon the mill making the quilts; it may be from 25 to 60 per cent. Generally speaking, card and comber waste is used.

PICKING.

The finer mixture is put through an opener and three processes of picking,

the speeds and other particulars being the same as given in our last article for the number yarn. For the coarser yarn only two processes of picking are used, the speed of the beater at the breaker being 1,500 revolutions per minute, and at the finisher being 1,400 revolutions per minute. The total weight of the lap at the breaker is 40 pounds and at the finisher 39 pounds, or a 16-ounce lap at breaker and a 15-ounce lap at finisher. A variation of 12 ounces either side of standard weight is allowed for these be taken to see that the wire fillet on the top flats does not become choked up with the fly. In cards that have been in use for some time it is the rule rather than the exception to find fly at this point. Sometimes an adjustment of the brush up may entirely remedy the defect, but if not the fly has to be picked out by hand; or a better way is to put the stripping brush on the grinding brackets and drive it at a slow rate of speed until the flats have made either two or three complete revolutions.

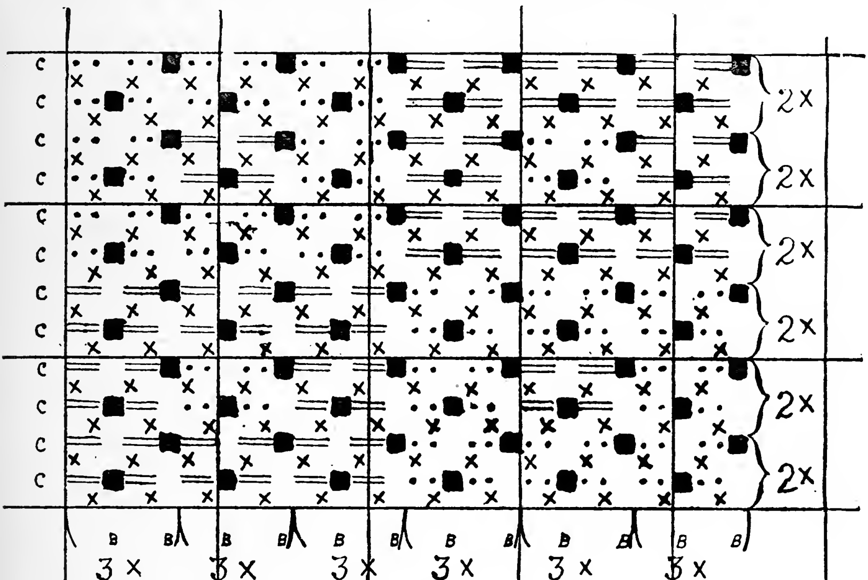


Fig. 4

laps. Look out to keep your drafts so regulated that they will not cause the laps to split and lick. These laps are next put up

AT THE CARD

and as it is the custom to use but one count of wire fillet in a mill, the count used for this style of quilts would be the same as that used for bedspreads as given in the last article.

The other particulars given in that article may also be used. Care should

ANOTHER POINT

to look out for is to see that the top flats are ground perfectly even. A great many overseers, if they look at the flats sharply, will be surprised to see that they are grinding more off of the back of the flat than at the front. This may not be the grinder's fault, but may be due to a defective grinding device, the main point being that they are not grinding in the same manner as they are working. It is just as well to grind the flats at

least once a year on a flat grinding machine, the flats having to be taken off to do this; which of course means the loss of production for that card for a certain length of time, but it will mean a better quality of sliver, which will more than offset the former, as a great deal closer settings may be used.

THE PRODUCTION

for a week of 60 hours for all counts of yarn (in this article) except the 3s should be 825 pounds and for the coarse yarn 950 pounds. The weight of the card sliver is 65 grains for all stocks. The yarn is next put through three processes of drawing for the finer counts and two processes for the coarse yarn. The top rolls used may be either leather covered or metallic. The advantages of both have been previously stated. The speed of the front rolls for the longer staple cotton is 400 revolutions per minute, and for the short staple 425, if convenient; or it may be run on the same line of machines as the longer staple cotton, when the speed of the front roll would have to be the same. The weight of the sliver for the 30s and 20s yarn should be 70 grains per yard and for the 3s, 80 or 85 grains per yard. The sliver is put through the slubber and made into .60 hank roving for fine counts and .40 hank roving for the coarser count. The roving for the 30s is put through two processes of

FLY FRAME,

the hank roving being as follows: Two hank for first intermediate and 6.25 hank for the next process; for the 20s the hank roving would be just the same at the first intermediate, but 4.50 at the last process. For the 3s the roving would be put through only one more process, where it would be made into 1 hank roving. It is the general custom to spin the yarn for this class of fabric on mules on account of the soft twist being put into it, but in some cases the yarn is spun on the ring frame. The particulars given in previous articles for 20s and 30s yarn may be used, with the exception of the twist, which should be less than that given. If mule spun, the standard for twist used should be 2.75 times the square root of the count. If the 3s are spun on a ring frame, a frame should be used with a $2\frac{3}{4}$-inch gauge, $1\frac{5}{8}$-inch diameter ring, 6½-inch traverse. After passing through the ring frame the warp yarn is put through the spooler and warper and then through the slasher, and finally run upon a beam which has the required number of ends to make the quilt.

Dyeing Particulars.

SKY BLUE FOR STRIPES.

One per cent diamine sky blue F F; 2 per cent sal soda; 20 per cent Glauber's salt.

PINK.

One-half per cent diamine rose B D; 2 per cent sal soda; 20 per cent Glauber's salt.

LIGHT YELLOW.

One per cent chromine yellow G; 2 per cent sal soda; 20 per cent Glauber's salt.

LIGHT BROWN.

One-half per cent naphtamine brown N; ¾ per cent naphtamine yellow N N; 2 per cent sal soda; 20 per cent Glauber's salt.

RED.

Four per cent benzo fast red 4 B; 30 per cent Glauber's salt; 2 per cent sal soda.

LIGHT SLATE.

One per cent diamine black B H; 2 ounces diamine fast yellow B; 2 per pent sal soda; 20 per cent Glauber's salt.

LIGHT GREEN.

One per cent diamine sky blue F F.; 1¼ per cent diamine fast yellow F F.; 2 per cent sal soda, 20 per cent Glauber's salt; after-treat with 2 per cent sulphate of copper.

PEARL.

One-quarter per cent diamine dark blue B.; ¼ ounce diamine fast yellow B.; 2 per cent sal soda; 15 per cent Glauber's salt; after-treat with ½ per cent bichrome; ½ per cent sulphate of copper.

RAINCLOTH

Raincloth, commonly so-called, has no particular style of construction or character of weave, the name being acquired from the fact that the fabric is waterproofed during the finishing process.

The most popular and best grades of raincloth may be defined as closely woven, smooth-face fabrics, made with twist warp, that is, cotton and wool, of cotton and worsted twisted together, and with all worsted or wool filling. The weave used for this fabric is what may be termed a five-harness satin $\frac{3}{\quad 2}$, see Fig. 1. This fabric, as the name implies, is exclusively made up into raincoats or cravenettes, worn principally as a covering in damp or rainy weather. The fabric, after it is finished, is impervious to water.

Raincloth is a piece-dyed fabric. Such shades as drabs, fawns, light and dark browns and black are the prevailing colors. The warp yarn, as already mentioned, is a two-ply thread, composed of a very fine cotton thread and coarser count of worsted or woolen thread. The fabric is given a wool dye. The cotton does not take on color. The finished fabric presents what is termed a powdered effect, that is, little specks of white show over the entire surface of the fabric.

The fabric may be elaborated by means of mercerized cotton threads being inserted at regular intervals in both warp and filling, producing check or plaid effects, or by using a given number of solid worsted threads and a given number of twist threads arranged in some order producing a stripe effect. The fabric is also varied as regards quality, in so far that it is made with coarser counts of yarn, and less ends and picks per inch; in the cheaper qualities the plain weave and $\frac{2}{\quad 2}$ twill are much in evidence.

Analysis follows of a first-class fabric:

Width of warp in reed, 60 inches; width of fabric finished, 56 inches; ends per inch in reed, 84; ends in warp, 5,040.

21x4 reed.

Take-up of warp during weaving, 8 per cent.

Weight per yard finished, 10 ounces.

Warp yarn 2-50s worsted counts, composed 1 end of 1-30s worsted, 1 end 1-100s cotton.

Filling, 80 picks per inch in loom, 1-35s worsted yarn.

LOOM REQUIRED.

For plain raincloth, that is, a one-filling fabric, a broad dobby loom, speed from 140 to 150 picks per minute, may be used; for the five-harness satin weave the warp is usually drawn in on 10 harnesses straight draw, so as not to overcrowd the heddles and prevent chafing of the warp; for fancy raincloth the box, pick and pick loom is the one best suited for these fabrics.

FINISHING.

The better quality of raincloth requires considerable attention in the finishing process. After the fabric comes from the loom, it is dyed, the wool or worsted only taking color, the cotton in the warp yarn remaining white. Twist yarn is more or less irregular, that is, the cotton may be more prominent in some places than in others; this requires the fabric to

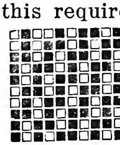


Fig. 1.

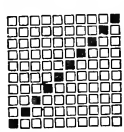


Fig. 2.

Drawing-in Draft.

be examined and where the cotton is found to be too prominent, it is darkened or inked in conformity with the ground color, after which follows the waterproofing process. This consists of immersing the fabric in a combination of ingredients, such as greasy matters of all natures, resin, paraffin,

tannic acid, drying oils, salts of alumina, alums and carbonate of magnesia. After it is waterproofed, the fabric is pressed, made up into rolls, then made up into garments.

Carding and Spinning Particulars.

As has been stated in the analysis of raincloth given above, the material used in the construction of the yarns is wool and cotton. As in the carding and spinning particulars only the construction of the cotton yarn has been described we will follow the usual custom and give the processes, with the particulars at each stage, through which the cotton passes to produce the finished yarn. The count of the cotton yarn described for this fabric is 100s. This may be made from either a fine, long-stapled Egyptian cotton or from a Sea Island cotton of a staple of 1½ to 1⅝ inches, the latter being the one most generally used. The bales of cotton are first stapled and graded and all those not up to standard length and quality are put one side, while the rest are mixed by hand.

A LARGE MIXING

is made so that there will be as few changes as possible in the yarn made from the different batches. It will be understood that it is often necessary to change certain parts of different machines for almost every mixing so as to suit some peculiarity of the mixing being made. These changes are generally slight and many times only mean the changes of certain speeds of settings, but when running the different mixings the first lot run through should be carefully watched to see that it compares exactly with the foregoing mixture.

SEA ISLAND COTTON

of a long staple is put through only two processes of picking and an opener. Some overseers put the cotton through only one process. The beater used is generally of a two-bladed, rigid type and if two processes are used the speed of the breaker is 1,300 revolutions per minute and the speed of the second, 1,100 revolutions per minute. As will be seen, this speed is reduced considerably from that of the other cottons that have been previously described and the reason is that a greater speed of the beater puts in neps, which, as every one knows, is the one thing to be most feared, because dirt can be taken out, but it is almost impossible to take out neps. To be sure, a greater portion of them are taken out, but it means much extra work and care to do it, so it is always best to see that none are put in. The beats per inch given to the cotton as it is passing through the finisher picker are 29. The total weight of the finished lap is 28 pounds or a 9½-ounce lap.

These laps are put up

AT THE CARD.

The settings used for this card should be close, a 12-1,000ths-inch gauge being used to set the flats from the cylinder and a 5-1,000ths-inch gauge to set the doffer from the cylinder. The wire fillet used should be No. 34s for cylinder and 36s for doffer and flats. The card should have as many working as possible and the speed should be one complete revolution every 35 minutes. The draft of the card should never be less than 130 and some overseers increase this to 175 or 180 on this class of work. The stripping should be done three times a day and grinding as usual. The card should be kept unusually free from fly and dirt and should produce from 250 to 300 pounds per week of 60 hours. The weight of the sliver should be 40 grains per yard. Another part of the machine that is changed differently from all other stock is the speed of the licker-in. This should be a great deal less than that used for other stocks for the same reason as given for the low speed of the beater. The speed of the licker-in should be dropped from 350 to 400 revolutions per minute (the usual speed) to about 275 revolutions per minute. The card sliver is next combed. The different

COMBING PROCESSES

vary, but those in most general use are as follows: Sliver lap machine,

ribbon lap machine and comber. The width of the lap is another part that has also been changed so that now it is 10½ inches, whereas formerly an 8¾-inch lap was almost universal. The following particulars will be given for an 8¾-inch lap; when a 10½-inch lap is used the proper weights may be calculated by proportion. The doublings at the sliver lap are 14 for an 8¾-inch lap and 20 for a 10½-inch lap.

The weight of a yard of lap at the front is 280 grains. These are put up at the ribbon lap machine and doubled 6 into 1. The weight of a yard of lap at the front of this machine is 265 grains. The laps are put up at the comber and doubled according to the number of heads that the comber contains; formerly it was the custom to have six heads, but within the last few years a comber of eight heads is used. The newest development in combers is the single head comber, many finding this more advantageous than the use of any of the previous machines. The

PERCENTAGE OF WASTE

taken out should be not less than 20 for this class of stock and the trimmings and settings should be as follows: Combing starts at 5. Nippers open at 3½, close at 9¼. Lifters down at 6¾ and up at 8¾ to 9¼. Top combs down at 5. Feed roll commences to move forward at 5½. The start of the feed roll to a certain degree controls the percentage of waste taken out and is the part that is changed after the settings of the comber have been made. A later feeding means an increased amount of waste. The detaching roll moves forward at 5¾. There is a great deal of difference in settings, of the top combs to segment and cushion plate to needles or cylinder, among comber men, but good settings even for this grade of stock are with an 18 gauge from cushion plate to half lap and a 21 gauge from top comb to segment. Either a double or single row of needles in top comb may be used, both having their advantages and disadvantages. The weight of the sliver should be about 35 grains per yard. The sliver is next put through two processes of

DRAWING FRAMES,

the weight of the drawing at the finisher drawing being 60 grains per yard. Leather-covered top rolls are generally used for this stock and should be kept in perfect shape and frequently varnished, as should the leather detaching rolls of the comber and the top rolls of the sliver lap and ribbon lap machines. Several good recipes for varnish have been given in previous articles, one of which may be used. The sliver is put through the slubber and made into .80 hank roving. The front top rolls of this machine are generally varnished and some mills use rolls of a larger diameter, claiming less licking. The twist put in is the square root of hank being made. The slubber roving is next put through three processes of fly frames, the hank roving at each process being as follows: First intermediate, 2.25; at the second intermediate, 5, and at the jack frames, 20 hank. The standard twist per inch is the square root of hank times 1.10 at first and second intermediates and 1.20 at fine or jack frames. Care should be taken to see that the roving is properly laid on the bobbin and that the bobbin, when full, is properly built; also that the settings of the rolls and traverse are correct. This yarn is either mule or ring spun. If ring spun the particulars for a frame making 100s yarn are as follows: Gauge of frame, 2¾ inches; diameter of ring, 1⅜ inches; length of traverse, 5 inches; speed of spindles, 9,400 revolutions per minute. This yarn is then spooled and then is in shape to be twisted with the worsted yarn.

Dyeing Particulars—Piece Dyeing.

LIGHT OLIVE BROWN.

One-half per cent anthracene acid brown G.; 6 ounces anthracene blue C.; 2 per cent sulphuric acid; after-treated with 1 per cent chrome.

MEDIUM BROWN.

One and one-half per cent anthracene chrome brown D.; ½ per cent anthracene yellow B. N.; ½ per cent anthracene acid blue D.; 2½ per cent sulphuric acid; after-treat with 2 per cent chrome.

NAVY BLUE.

Four per cent anthracene acid blue D.; ¾ per cent anthracene chrome violet B.; 3 per cent sulphuric acid; after-treat with ½ per cent chrome.

SLATE.

One-half per cent anthracene blue C.; ¼ per cent anthracene chrome brown D.; 1 per cent sulphuric acid; after-treat with ½ per cent chrome.

OLIVE.

One and one-half per cent anthracene acid brown G.; ¾ per cent anthracene brown; ½ per cent anthracene yellow B. N.; 1 per cent sulphuric acid; after-treat with 1 per cent chrome.

DRAB.

Six ounces anthracene blue C.; ½ per cent anthracene chrome brown D.; 1 per cent sulphuric acid; after-treat with 1 per cent chrome.

BLACK.

Six per cent anthracene chrome black F. E.; 4 per cent aceteic acid; 2 per cent sulphuric acid; after-treat with 2 per cent chrome.

DARK BROWN.

One per cent anthracene yellow B. N.; 3 per cent anthracene chrome brown D.; 1½ per cent anthracene acid blue D.; 3 per cent sulphuric acid; 2½ per cent chrome.

DARK GREEN.

Three per cent anthracene yellow B. N.; 1 per cent anthracene chrome brown D.; 3 per cent anthracene blue C.; 3 per cent sulphuric acid; after-treat with 3 per cent chrome.

COTTON CASSIMERE

Cassimere was originally understood to mean a woolen cloth used for men's wear. This fabric differs from cashmere in so far as the latter is finer and used principally for ladies' dress goods. Cashmeres are usually in solid colors only, and were originally made in Cashmere and near-by regions from yarn hand spun from the flossy wool of the Cashmere goat.

"About the year 1816, a small herd was imported into France with the view to acclimatize them and breed them for the sake of their wool, but the enterprise failed." The foregoing facts will suggest that this fabric is quite costly, consequently cheaper grades, cotton and wool imitations, have a liberal demand.

In varying the quality of a fabric, the manufacturers have two objects in view: first, to reduce the cost; second, to retain the same general appearance. It then follows that the change effected is of degree, not of kind, consequently the variations usually consist in changing the number of ends and picks per inch, or substituting a higher or lower grade of yarn as the case may be.

ANALYSIS.

— x x x
25. 1—1—1

FACE WARP.

3	ends		Black.
7	—	1	Black and drab.
	—	1	Black and white.
2	—		Black.
1	—		Black and white.
1	—		Black.
1	—		Black and white.
2	—		Black.
7	—	1	Black and drab.
	—	1	Black and white.
1	—		Black.
x2	—		Black.
x1	—		Bleach.
28			

BACK WARP.

1	Green x.
2	Black.
1	Drab.
1	Black.
1	Drab.
3	Black.
1	Drab.
2	Black.
1	Drab.
1	Black.
1	Drab.
2	Black.
1	Drab.
3	Black.
1	Drab.
1	Black.
1	Drab.
4	Black.
28	

x Alternate garnet.

FACE WARP.

11 ends Black 2/30.
8 ends Black and drab 2/30.
8 ends Black and white 20/60.
1 end Bleach 2/40.

28

BACK WARP.

19 ends Black 2/30.
8 ends Drab 2/30.
1 end Green 2/30.

28

ENDS IN FACE WARP.

726 ends Black.
528 ends Black and drab.
528 ends Black and white.
66 ends Bleach.

1,848
40 ends selvage.

1,888

ENDS IN BACK WARP.

1,254 ends Black.
528 ends Drab.
33 ends Green.
33 ends Garnet.

1,848
40 ends selvage.

1,888

Filling 60 picks per inch, 2/26s black cotton.

Width of warp in reed, 34 inches; width of fabric finished, 31 inches; outside ends per inch, 111; 500x8 reed; ends in face warp, 1,848; 20 ends 2-30s white selvage; total ends in face warp, 1,888; ends in black warp, 1,848 20 ends 2-30s white selvage; total ends in back warp, 1,888; total ends in face and back warp, 3,776; take-up of face warp during weaving, 10 per cent; take-up of warp during weaving, 6 per cent.

Weight of fabric per yard from loom, 7.85 ounces. Weight of fabric per yard finished, 7 ounces.

When both warp and filling are changed from wool to cotton, as with the cassimere under consideration, the general appearance may be retained, but the feel or handle of the fabric will be entirely different—so much so that it will be apparent to the buyer.

When such radical changes are made in fabrics as to substitute cotton for wool, it can no longer be sold under the same name; it therefore follows that the fabric be designated, as, for instance, cotton cassimere.

In making these cheaper grade fabrics, the methods of manufacturing are simplified as much as possible, chiefly because the profit will not admit of any unnecessary expense. No intricate weaves are used; such weaves as $\frac{2}{2}$ twill, $\frac{2}{2}$ basket weave and common rib weave are principally used for operating face warp. These fabrics are generally made with two warps. The back warp interlaces with filling on the 8-harness satin order. (See Fig. 1.) These fabrics are confined to 16 harness, 8 harness for face warp and 8 for back warp; the warp is drawn in one end face, and one end back, the first end of face warp on the first harness, the first end of back warp on second harness. (See draft, Fig. 2; Fig. 3, chain draft).

The back warp for these fabrics is usually plain yarn, twist yarn being

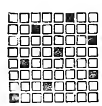


Fig. 1.

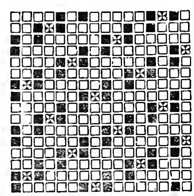


Fig. 3.

too expensive and the pattern of the back warp usually differs from the face warp in regard to the color arrangement, but the number of ends must be the same, if one end face warp and one end back warp fabric is required.

LOOM REQUIRED.

These fabrics may be woven on any box, harness loom. The loom should have stands for two warp beams, one for face warp and one for back warp; in some instances both warps are beamed on one beam, the back warp beamed tight because of less take-up.

FINISHING.

After the fabric comes from the loom, it is burled, examined and mended if necessary. The face of the fabric is sheared, after which it is run through a rotary press. The fabric in passing through the press runs over a perforated steam pipe, which

partially saturates the fabric, then it is pressed by passing through heated cylinders, after which it is made up into rolls, then shipped.

Carding and Spinning Particulars.

Different mills make cotton cassimere out of different counts of yarn, but the fabric under description is composed of 2-30s warp and 2-26s filling. These yarns would be made in a mill belonging to the second division, as given in a previous article. The yarn would be made from American cotton of a fair grade, having a staple of about 1 1-16 inches. The mixing should be done by one of the various methods that have been given in previous articles. The only point to be looked out for is to see that the cotton is thoroughly dry and aired out before being put through the opener. For this class of fabric the raw stock is put through three processes of picking and an opener. The good waste from all machines up to the slubber is mixed in before the cotton is fed to the opener. This waste should be picked up at regular and frequent intervals and spread throughout the entire mixing, and should not be allowed to accumulate in large lots, but should be run up as fast as collected. The

LIFTING APRON

should always be carrying up a load of cotton for the pin beater to strike off. This beater should be so adjusted that the proper amount of cotton is passed to the breaker picker, which is generally either directly connected or is connected by trunking or lattice work to the opener. The beater of the breaker picker for this kind of stock is generally of a two-bladed rigid type and its speed is 1,550 revolutions per minute. The total weight of the lap at the front is 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled four into one. The beater of this machine is also generally of a two-bladed, rigid type, the speed of which is 1,500 revolutions per minute. The total weight of the lap at the front of this picker is 37 pounds or a 10-ounce lap. These laps are put up at

THE FINISHER PICKER

and doubled four into one. It is at this point that the cut-roving waste is mixed in with the raw stock. This is done by two methods, both of which have been described in a previous article. If done by hand, care should be taken to see that the percentage of cut waste mixed is not too great, because this is apt to cause licking of the laps when they are being run at the card. The beater of this machine may be either a two-bladed rigid or a pin beater, either of which has its advantages. If of the two-bladed, rigid type, the speed should be 1,450 revolutions per minute. This gives the cotton passing under its action 42 beats per inch. Care should be taken to see that all the drafts in the pickers are properly directed where they will do the most good. The total weight of a lap for this class of goods should be 39 pounds or a 14½-ounce lap. A variation of the standard of half a pound (either side) is allowed.

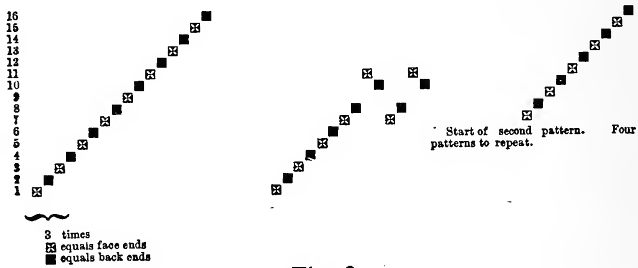


Fig. 2.

All laps varying more than this are run through the finisher picker again. The picker laps are put up

AT THE CARD,

the draft of which for this class of work should not exceed 100. The wire fillet used should be No. 33 for cylinder and 35s for doffer and flats. This is the American count of the wire; the equal English count is No. 100s for cylinder and No. 120s for doffer and top flats. The settings of the card should be the same as given in connection with the article on "Indigo Prints." Strip cylinder and doffer three times a day and grind lightly at least once a month—twice a month is better—and then leave the grinder on half a day. The teeth should always be kept sharp and never allowed to run faced. It is the general rule of grinders to set cards after grinding in large rooms where several grinders are employed. It is better to have one grinder or boss grinder to set all the cards and hold him responsible. Keep cards clean, especially the front end around and over the doffer bonnet. The speed of the licker-in should be 375 revolutions per minute. The flats make one complete revolution every 45 minutes. The sliver at the front weighs 65 grains per yard and the production is 800 pounds per week of 60 hours.

THE SLIVER

at the cards should be sized at least once a week to see how it is comparing with previous sizings. The sliver is next put through three processes of drawing frames, which may have either metallic or leather-covered top rolls. If metallic rolls are used, keep them clean, because if dirt and waste collect in the flutes of either the top or bottom rolls, cut roving is almost sure to result. Keep top and bottom rolls well oiled. If top rolls are not kept oiled and are allowed to become dry, bad work is sure to result. Also see that the calender rolls have enough pressure on them to cause them to condense the sliver properly. Look out to see that the trumpets have the right size hole at the small end. The drawing frame sliver should be sized at least three times a day, and if sized four times it keeps the work a great deal evener. The sliver from at least four heads of each frame is taken and sized separately and then averaged; a variation of not more than 5 grains either side of standard is allowed; if more than this, the draft gear is changed.

THE DOUBLINGS

at the drawing for this kind of work are 6 into 1 at each process. The speed of the front roller is 400 revolutions per minute. The weight of the sliver is 70 grains per yard. The drawing is next put through the slubber and made into .60 hank roving. It is not customary to varnish the slubber top leather rolls for this kind of work. See that the traverse is working properly and that the top rolls are in perfect condition and set properly. Keep slubber as clear as possible and it will make returns many times over in extra production, which is often affected by dirt, fly, etc., getting between the gears and filling up the teeth.

THE SLUBBER ROVING

is put through two more processes of fly frames, the hank roving being made at each as follows: First intermediate, 2.00, and second intermediate, 6.00 hank for the warp yarn and 5.25 hank for the filling yarn. Try to keep the roving a little on the heavy side of the standard and don't put more twist into roving than is actually needed to draw it, so that it won't break back at the next process. Remember that every extra tooth of twist put in cuts into the production to that extent. Keep the top rolls in good condition and change them frequently. Keep the chains clean and look out for bunches. Look out for single and double and watch the tension and the taper of the bobbin. Do not let the help fill up the bobbin after the frame has knocked off, but first be sure that the frame will knock off at the proper place. Keep frames well oiled and don't run bare spindles.

Another thing to watch is jumping bobbins; set the gear

properly to remedy this. Replace all broken bolsters as soon as possible. After changing a frame over, use up all pieces from it as soon as possible. The roving for the warp yarn is spun on a ring frame, having the following particulars for 30s yarn: Gauge of frame, $2\frac{3}{4}$ inches; diameter or ring, $1\frac{3}{4}$; twist per inch, 26.02, and speed of spindle 9,800 revolutions per minute. The yarn is then spooled, twisted into 2-ply yarn, spooled, and then warped, after which it is put through the slasher and run onto a beam with the required number of ends. The roving for filling may be either mule or ring spun; if the latter, use a frame with a $2\frac{3}{4}$-inch gauge, $1\frac{5}{8}$-inch diameter ring and spindle speed of 8,000. This yarn is then twisted into 2-ply 26s, after which it is conditioned and then is ready to be used.

Dyeing Particulars.

BLACK.

Ten per cent thion black TBC.; 20 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

BROWN.

Ten per cent thion brown R.; 2 per cent thion violet black A.; 1 per cent thion yellow G.; 10 per cent sodium sulphide; 2 per cent soda ash; 25 per cent salt.

DARK GREEN.

Eight per cent thion green B.; 8 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

PEARL.

Four ounces thion violet black A.; 1 per cent thion black TBC.; 1 per cent sodium sulphide; ½ per cent soda ash; 10 per cent salt.

DRAB.

Three per cent thion green G.; 3 per cent thion orange N.; 6 per cent sodium sulphide; 2 per cent soda ash; 20 per cent salt.

NAVY BLUE.

Six per cent thion navy blue R.; 2 per cent thion blue B.; 8 per cent sodium sulphide; 3 per cent soda ash; 30 per cent salt.

SLATE.

One and one-quarter per cent thion black TBC.; 1½ per cent sodium sulphide; 2 per cent soda ash; 10 per cent salt.

RED.

Twenty per cent thiogene rubine O.; 10 per cent sulphide sodium.

BLUE BLACK.

Ten per cent thion blue black B.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

ONDULE FABRICS

Ondule fabrics are characterized by having one or both series of yarns warp or filling, drawn out of a straight line, while yet remaining in the same relative positions, i. e., the curving of the yarns is not made by certain yarns

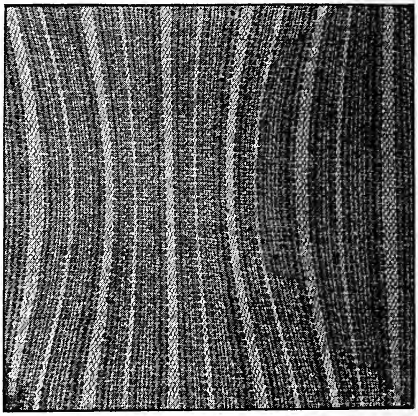


Fig. 1.

crossing over others as in leno and similar fabrics.

They may be placed in the novelty class. As such, the production is limited in quantity in cotton goods by several factors, among which may be mentioned: First, costly loom attachments have to be applied in order to weave them to the best advantage; second, the demand is small and uncertain.

Fig. 1 illustrates the effect formed in warp ondules, in which the filling re-

mains in straight lines, as in any ordinary fabric. The warp forms the undulations.

This type has not been developed to any extent in cotton goods on account of the reasons mentioned, and for another reason. Some of the ends curve considerably more than others, necessitating the use of several warp beams in order to have the ends at such a tension that some will not be slack in the shed, while others are tight. The sample in question, although containing only two different counts of warp yarns, one fine and one coarse, required five warps.

It will be understood readily that a greater length of warp will be required for a curved end than for a straight end in a given length of cloth.

The white warp yarn in Fig. 1 is cotton.

When woven in only one color or

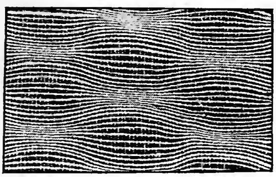


Fig. 2.

one count of warp the stripe effect is very faint.

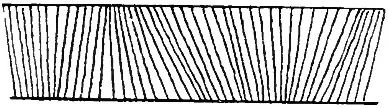
The ondule principle of construction is not of recent origin, similar goods having been made to some extent in the early part of the 19th century.

Filling ondules are of more recent origin than warp ondules, and may be made much cheaper, one warp only being required. Fig. 2 illustrates the effect of a good filling ondule, in which the filling yarns form curved or wavy effects, the warp yarns remaining parallel to each other. The filling is considerably coarser than the warp, which accentuates the desired effect.

Fabrics like Figs. 1 and 2, or of combinations of these two effects, may be made with similar loom attachments or devices. The attachment generally used consists of a suitable mechanism, varying in detail with different makers, for imparting to the reed, which is very deep, an up-and-down movement, so as to bring a different part of it to the fell of the cloth at each pick.

The reeds used are of special construction. In those used for warp ondules the dents are arranged somewhat like Fig. 3.

Fig 3



The top, bottom and face of the reeds are straight, as in ordinary reeds.

For weaving filling ondules the same device may be used for actuating the reed. The reed itself is made after the form shown in Fig. 4. The solid line indicates the top, and the dotted line the bottom of the reed. The dents are equal distances apart, both at the top and bottom. When this type of reed is used, a false reed is also used as a guide for the shuttle, as in lappet weaving. Another type of reed used is made fast at one end, and in loose sections at the other. These sections contain, say, three or four dents. An engraved or grooved roller is made to separate and change the positions of the sectional end of the reed as desired.

In addition to the methods described for producing ondule fabrics there

Fig 4.

is a newer method which has come into use in recent years that is probably much more economical and produces better results, at least for those fabrics which have the waves in a filling direction. This method of production is comparatively simple, and may be described as follows: There are two sets of harnesses, and the warp threads are drawn through both sets.

Only one warp is required for most styles of effects. At the back of the loom is placed an extra set of harnesses, four or more being employed. These harnesses are bound together tightly, but instead of being all level, they are arranged at different heights and are all lifted or depressed together. The warp threads are drawn through the heddles in these back harnesses and then through the regular harnesses at the front of the loom which produce the weave. The back harnesses are merely for the purpose of placing tension upon the

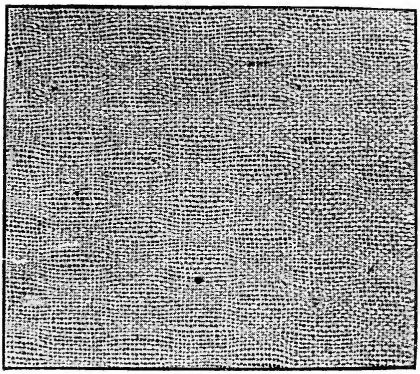


Fig. 5.

various warp threads, those which are lifted the highest having the greatest amount of tension, etc. The back harnesses which are bound together are raised and lowered slowly, and the length of the wave determines the kind or the number of picks when the raising and lowering repeats. Of course, good yarn has to be used in making a fabric in this method, but if care be used the tension on the various threads will not be great enough to cause any large amount of breakages. Quite a number of different styles of fabrics have been produced by this method, and highly desirable results secured at a relatively low cost. The width of the wave in the warp direction is determined by the method of drawing-in the threads on the back harnesses and the length of the wave in the filling direction is regulated by the raising and lowering of the harness. These back harnesses can be operated from the dobby head, inasmuch as such fabrics are usually made upon the ordinary dobby loom.

Fig. 5 illustrates a cotton fabric intended to imitate the high-class filling ondules. To obtain this effect two leno easers or slackeners have been used instead of the reed motion. There are 30 ends in each pattern, 15 of which were placed over the first and 15 over the second easer. The easers were then actuated so that the yarn over one of them wove slack for eight picks, while the yarn over the other was held tight, then vice versa for eight picks. The selvage ends were placed over the regular whip roll. Two warp beams were used, although one would perhaps have answered better. This is a simple method of obtaining the waves, but the effect obtained is not as good as when a special reed is used; nor can it be depended on, not being a positive motion. The easers have to be adjusted to a nicety and kept in that condition or each alternate section will appear more prominent than the others.

Fabrics showing a much better effect than that shown in Fig. 5 may be produced by the yarn easing method.

The construction data for the sample is as follows:

Ends per inch, 48; picks per inch, 48; width, 27 inches; warp yarn, 50s cotton, combed American; filling yarn, 2-40s cotton, Sea Island, mercerized; 696 ends on number 1 beam—this includes 48 for selvages; 648 ends on number 2 beam, total, 1,344 ends; weight, 8 yards per pound; reed, 1 end in each dent; the weave is plain on 4 harnesses. The attachments can be applied to and these goods made on any ordinary dobby loom.

Carding and Spinning Particulars.

There are a great many different styles of ondules, and these comprise many different counts of yarn according to the grade and quality of the fabric being made. This class

of fabric is made in mills of the third division, as given in a previous article, or at least those plants whose equipment of machinery includes combers. The fabric that has been selected out of this class of goods is made up as follows: For the warp, 50s yarn is used and an American cotton, generally the kind called peeler, having a staple of 1¼ to 1 5-16 inches, being used and for this fabric is combed. For the filling yarn a Sea Island cotton of 1½ inches is used. This is also a combed yarn, the count of which is 2-40s. For this article we will take each yarn and treat it separately, starting with the mixing.

MIXING.

First take the American yarn. This is mixed, as has been previously stated, at the mixing bin; the sliver waste from the machine up to the slubber is used. Care should be taken to see that too great an amount of this is not being made at the different machines. It is impossible to avoid making this waste altogether, but a large percentage of it may be saved if watched carefully. This cotton is put through an opener and three processes of picking. Keep the hoppers of the openers well filled, so as to obtain as even a feed as possible at the breaker picker. The speed of the beater at this machine is 1,050 revolutions per minute. See that the pin beater is set properly to obtain the required weight per yard of cotton being fed to the breaker picker. This picker is generally provided with a two-bladed, rigid type of beater, the speed of which is 1,550 revolutions per minute for this class of work. The total weight of lap at the front is 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. The beater of this picker is like that of the breaker, and its speed is 1,450 revolutions per minute. The total weight of the laps at the front of this picker is 37 pounds or a 12-ounce lap. The laps are put up at the finisher picker and doubled 4 into 1. The speed of the beater, if a rigid, two-bladed type, is 1,450 revolutions per minute, which gives the cotton passing through it about 42 beats or blows per inch. The total weight of the lap at the front is 37 pounds or a 12½-ounce lap. A variation of one-half a pound is allowed either side of standard; laps over or under this weight are run through the finisher again. At the finisher picker the cut waste from the fly frames is mixed in in the proportion of one lap of cut waste to three laps of raw stock. Be careful not to use too much cut waste, as it is apt to cause the laps to kick; also be careful to see that the drafts of the pickers are properly directed for the same reason. At the card the draft is not less than 100, a good draft being 120. The speed of the cylinder is 160 revolutions per minute; licker-in, 300 revolutions per minute; and the top flats make one complete revolution every 34 minutes.

DOFFER AND CYLINDER.

The doffer should be as large as possible and clothed with a No. 35s wire fillet, as should the top flats; the cylinder is clothed with No. 34 wire fillet, the equivalent English count being 120s for doffer and 110s for cylinder. Keep this wire sharp at all times, as dull wire is apt to cause kinked yarn. Grind at least once a month and reset all points after grinding. It is a good plan, although one not generally used, to brush out cylinder and doffer after grinding and before setting up. See that the grinding brackets for the top flats are set so as to grind the flats evenly across their face, when in their working position. This is

A GREAT FAULT

with most of the grinding devices and should be carefully looked into. See that the doffer stripping comb is set to clean the doffer of the web properly. Strip cards three times a day and keep front free from dirt and fly. The total production for a week of 60 hours, allowing 10 per cent time for stoppages, etc., is 550 pounds, and the sliver weighs 45 grains per yard. The sliver is then combed.

BEFORE BEING COMBED

it has to be run through several different processes. The order of these, as well as the machines themselves,

differs, but it is most general to have the machines as follows, especially for this class of work: Sliver lap machine, at which the doublings for an 8¾-inch lap are 14 into 1, the draft of this machine being small, less than 2; the weight per yard is 285 grains; for larger width laps the doublings and weight per yard may be found by proportion; this is also true at the ribbon lap machine. At the ribbon lap machine the doubling is 6 into 1, and the weight of the lap is 265 grains per yard. These laps are put up

AT THE COMBER

and doubled according to the number of heads, 6 or 8 being generally used, a 6-head comber generally using an 8¾-inch lap and an 8-head comber a 10½-inch lap. These particulars are given for the Heilmann combers and not the later foreign makes, which have been tried with varying success the last four or five years. For this stock take out 15 per cent waste and set time as given in a previous article. The speed should be about 95 nips per minute. Keep all the leather top rolls of sliver and ribbon lap machines as well as those of the draw box and detaching rolls of the comber in perfect condition and well varnished. It is a good plan to varnish the leather-covered detaching rolls once a week. A little trouble in this direction is well repaid. Look out to keep the percentage of

WASTE

at the different machines uniform.

If two or more ends break down on the table, break end running into the can, and before piecing up again, see that all the ends are running. Combers should be scoured at least once a year, when they should be taken down and all parts reset and timed. Keep table smooth and polished and do not touch with the hands those parts over which the combed sliver is running. The weight per yard of the combed sliver is 40 grains. This sliver is put through two processes of drawing, being doubled 6 into 1 at each process. Leather-covered top rolls are generally used for this class of stock and they should be looked out for to see that they are well oiled and varnished and in perfect condition. See that all stop-motions are in working order so that single and double may be prevented as far as possible. The weight of the drawing is 70 grains per yard. This is put through the slubber and made into .50 hank roving, after which it is run through three processes of

FLY FRAMES,

the hank roving at each being as follows: First, 1; second, 3, and jack, 10 hank. Watch the leather rolls, also the shape and lay of the roving on the bobbins. Mark all roving small and distinctly near bobbins, and do not allow pieces to accumulate. This roving is taken to the ring spinning room and made into 50s on a frame having a gauge of 2¾ inches; diameter of ring, 1½ inches; length of traverse, 6 inches, and spindle speed of 10,000 revolutions per minute. The yarn is then spooled and warped, after which it is put through the slasher, where, in addition to being slashed, the required number of ends are run onto one beam, and then it is ready for the weave room.

The Sea Island cotton for

THE FILLING YARN

is put through either one or two processes of picking, generally two. The speed of a two-bladed, rigid type of beater at the breaker is 1,350 revolutions per minute, and the total weight of lap is 30 pounds or a 10-ounce lap. These laps are doubled 4 into 1 at the finisher picker. The speed of the two-bladed, rigid type is 1,250 revolutions per minute, or about 29 blows or beats per inch of cotton passing through. The total weight of this lap is 28 pounds or a 9½-ounce lap. At the card the draft should not be less than 120, and speed of the licker-in, 275 revolutions per minute. The top flats make one complete revolution every 35 minutes. The production is 300 pounds per week of 60 hours, and the weight of the sliver 40 grains per yard.

THE SETTINGS

for the card should be somewhat closer than when carding peeler cotton; for example, the doffer should be set

to the cylinder with a 5 instead of a 7 gauge, and the flats should be set with a 10 instead of a 12 gauge, which is used to set peeler cotton. The other particulars given above may be also used with Sea Island cotton. This sliver is next put through the same machines as given above for combing. The weight of the sliver lap machine is 240 grains per yard and the ribbon lap 220 grains per yard. The settings at the comber should be closer than those used on peeler cotton and the percentage of waste taken out should be 20 per cent. The weight of the sliver is 35 grains per yard.

This sliver is put through two processes of

DRAWING,

being doubled 6 into 1. The speed of the front roll should be 350 revolutions per minute, and the weight of the sliver 60 grains per yard. It is important that extra care be taken with the top rolls, stop-motions, etc., when running this kind of stock, otherwise the particulars given with peeler cotton may be followed. The leather top rolls of the slubber are varnished for this stock and it is better to use rolls of a little larger diameter than those used for peeler cotton. The hank roving made at the slubber is .65 which is put through two processes of fly frames, the hank roving made at each process being as follows: First intermediate, 2.25; and second, 8 hank. Use a finer grain leather for the roll covering than that used for peeler cotton and look out for all the particulars given above, except that extra care should be given to the Sea Island stock. This roving is taken to the mule room and spun into 40s yarn, after which it is generally mercerized under tension and twisted into two-ply 40s, when it is ready to be woven.

Dyeing Particulars.

LIGHT SKY BLUE.

Two ounces diamine sky blue FF.; 20 per cent Glauber's; after-treat with ½ per cent sulphate copper.

LIGHT PEA GREEN.

One-quarter per cent diamine sky blue FF.; ½ per cent diamine fast yellow FF.; 20 per cent Glauber's salt; 1 per cent sal soda; after-treat with 1 per cent sulphate copper.

PEARL.

Two ounces diamine brilliant blue G.; 15 per cent Glauber's salt; after-treat with ½ per cent sulphate of copper.

PINK.

One-half per cent Erika pink; 10 per cent Glauber's; 1 per cent sal soda.

CREAM.

One-thirty-second ounce diamine fast yellow B.; 1-64th ounce diamine catechine 3 G.; 10 per cent Glauber's; 1 per cent sal soda.

LIGHT BROWN.

One-half per cent diamine brown M.; 1 per cent diamine catechine 3 G.; 20 per cent Glauber's; 1 per cent sal soda; after-treat with 1 per cent chrome.

GREEN.

Two per cent diamine green G.; 20 per cent Glauber's; 2 per cent sal soda.

LIGHT SLATE.

Two ounces diamine dark blue B.; 1-16th ounce diamine fast yellow B.; 10 per cent Glauber's; 1 per cent sal soda; after-treat with ½ per cent chrome and ½ per cent sulphate of copper.

LIGHT SNUFF BROWN.

Six ounces diamine catechine 3 G.; 6 ounces diamine catechine B.; after-treat with ½ per cent chrome and ½ per cent sulphate of copper.

SLATE.

One per cent diamine black BH.; 2 ounces diamine fast yellow B.; 20 per cent Glauber's; 1 per cent sal soda; after-treat with ½ per cent chrome; ½ per cent sulphate of copper.

UMBRELLA CLOTHS

The name given to these fabrics indicates the use to which they are subjected. It stands for cloths of widely different qualities, materials and weaves. The weaves, with the exception of those used for umbrella

ginghams, are of small repeating types, as plain, three-end twill, and five and six end twills of four interlacings in a repeat.

Being subjected to extremes of weather, the constructions of the cloths are necessarily good.

All-cotton umbrella cloths are usually woven white, then piece dyed in solid colors. For cotton warp and worsted filling goods the warp yarn is usually dyed before being woven. This is especially the case in colors other than black. It is much harder to get a fast color, one of the essential features of a good umbrella cloth, on union piece-dyed goods than on yarn-dyed goods. Black is the principal color used.

IN THE BETTER GRADES

of umbrella cloths it is common to find silk or wool in combination with cotton. These materials are sometimes combined in the same yarn, being mixed before spun. In other cases the yarns on a beam are all of one material, and yarns of different materials, from separate beams, are used in one fabric.

The analysis of a good grade of umbrella cloth shows it to have been made of silk and cotton, the selvages being of silk and the body of the warp arranged two ends of cotton and one end of silk alternately. The filling is cotton. This is a so-called silk umbrella cloth.

A good cotton umbrella fabric with a twill weave is constructed as follows: Ends per inch, 84; picks per inch, 112; width in reed, 28¾ inches; width of cloth, 27 inches; ends in warp, 2,312; reed, 2 ends per dent; warp 60s combed American cotton filling, 40s combed Egyptian cotton; weave, $\frac{1\quad 1}{2\quad 1}$ twill. Plain selvages. The cloth was woven on 12 harnesses, 2 for selvages and 10 for ground.

One of the most essential features of a good umbrella cloth is a good selvage, as upon such depends not only the appearance of the cloth, but its utility. A cloth between two ribs of an umbrella would be worthless if it contained a broken selvage.

We will consider a plain weave umbrella cloth, containing a good selvage, where 2 picks work as one and 2 picks are inserted in each shed. The ground is reeded 2 ends in each dent and the selvages 4 ends per dent.

The construction of this fabric is 96 ends per inch of 60s warp yarn: 104 picks per inch of 56s filling; American warp and Egyptian filling, combed stock.

An ordinary single box dobby loom is generally used when making these goods, the large number of ends per inch necessitating a greater number of harnesses than are usually run on cam looms.

Care has to be exercised, when weaving, to make the goods as near perfect as possible, because defects made in the loom have to be remedied afterward, or the goods have to be sold as seconds.

FINISHING.

On account of the combinations of materials found in mixed umbrella fabrics, the finishing and dyeing processes are of great importance and have to be done with care in order that each material will look the same when finished and retain its color under severe usage. Especial care has to be taken with silk selvage goods, because, if the selvages are damaged, the goods have to be sold for other purposes, with a consequent loss in price.

Cotton umbrella cloths are singed or sheared, crabbed and steamed. If they contain silk selvages, the latter are moistened slightly just before they reach the singe plates or flames.

When the goods are required to be sheared, they are first thoroughly burled, all knots and other uneven imperfections being removed so that the cloth will present an even surface, free from holes, after shearing. When steaming and drying the goods, it is necessary to have them started and kept straight, so that the warp yarns may be straight and the width uniform throughout the piece.

Carding and Spinning Particulars.

The goods considered in this article are made in the same kind of mill and from the same grade of yarns as on-

dule fabrics, which were dealt with in the previous article. The carding and spinning data of the one will therefore apply equally well to the other, and need not be repeated here.

Dyeing Particulars.

FAST BLACK.

Dyed on the jig machine. First bath, 100 gallons; 8 pounds immedial black NN.; 10 pounds sodium sulphide; 3 pounds soda ash; 25 pounds common salt; run the pieces through for one hour, take off to a washing machine, and give a good rinsing with water; after-treat with 3 per cent chrome; 3 per cent acetic acid for 30 minutes at 180 degrees F.; soap with 10 pounds soap; 2 pounds olive oil; 4 pounds sal soda; 50 gallons water at 180 degrees F., and rinse. Boil the soap, olive oil and sal soda together for one hour before using. For subsequent lots 2 per cent soda ash, 7 per cent immedial black NN.; 8 per cent sodium sulphide, 6 per cent common salt will be sufficient for the dyeing process.

A SULPHUR BLACK

is the fastest to light, washing and general wear. Another black can be dyed with sulphur black topped with logwood: Six per cent immedial black NG.; 10 per cent sulphide soda; 2 per cent soda ash; 20 per cent salt; rinse well, and after-treat with 2 per cent chrome; rinse and dye with 5 per cent extract logwood; rinse and soap at 150 degrees F.; ½ ounce soap to 1 gallon water.

And again a good black can be dyed with a one-dip black fixed with chrome which is very fast to light and washing, but not so fast as sulphur black.

A ONE-DIP BLACK.

Ten per cent diamine fast black F.; 2 per cent sal soda; 30 per cent Glauber's salt; dye at the boil for one hour; rinse and after-treat with 2 per cent chrome; 2 per cent sulphate copper at 175 degrees F.; 3 per cent acetic acid; rinse well and soap with weak soap solution at 150 degrees F.

HUCKABACK TOWELS

Huckaback, or huck, is a name given to a certain type of weave which is extensively utilized in the manufacture of towels, being excellently adapted for that purpose.

Two of the principal features desired in a towel are, first, strength; second, a readiness to absorb moisture.

An examination of huckaback, Figs. 1 and 2, will show that it is composed for the greater part of plain weave; this gives strength to the fabric.

The moisture-absorbing qualities of a huck towel are aided by the long floats of yarn which appear regularly, as on ends and picks 2, 4, 7 and 9 of Fig. 2, as well as in the light twist or small number of turns per inch put in the yarns. The softer twisted the yarns, the better they are adapted for toweling.

The selvage ends, which are required to bear the greatest amount of friction of any of the yarns in the loom, are usually of 2-ply yarns, whereas the yarns in the body of the cloth are single, twisted not any harder than is necessary to enable them to weave well.

Huckaback toweling is sold to the consumers in various ways, by piece,

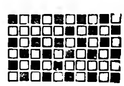


Fig. 1.

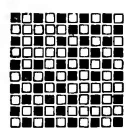


Fig. 2.

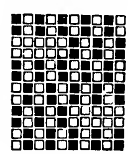


Fig. 3.

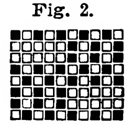


Fig. 4.

yard and towel. The cloth sold by the piece or yard is generally white. Completed towels, which are usually hemmed, hemstitched or fringed, vary in size from about 17 by 32, to 25 by 45 inches for general use. A favorite size for barbers' use is 14 by 26 inches. These are all white, or are white in the body of the towel and colored on

the borders, usually with light red or blue.

Towel borders usually consist of alternate stripes of colored and white filling, varying relatively in size as desired, and of weaves other than those of the huckaback type.

An analysis of a huckaback towel shows the following construction data: Ends per inch, 50; picks per inch, 44; width of cloth, 17½ inches; warp yarn, 14s; filling yarn, 10s; ends in warp, 854 of 14s for the body of the cloth, 40, i. e., 20 on each side, of 2-28s for selvages; 23 reed, 2 ends of 14s per dent; selvages, each 20 ends, drawn as 10 in 5 dents; the weave is shown in Fig. 3. The drawing-in draft for reproduction on a dobby loom is straight with Fig. 1 as a chain draft. Weave Fig. 3 differs from the chain draft Fig. 1 in having two picks in a shed.

To enable a greater length of cloth to be woven in a short time, in fact, in one-half the running time ordinarily required, two strands of filling are wound together as one on a bobbin and run off together in the loom. In reality, although the cloth contains 44 picks per inch, the shuttle traverses the loom lay only 22 times to weave one inch of cloth.

Another method of inserting two picks in a shed at once is by the use of a shuttle containing two bobbins of filling. Objections to this method are that it is necessary to use a shuttle of a greater length than can be run on an ordinary loom, and extra waste is made if the filling from both bobbins does not end at the same time.

Huckaback towels are usually made of linen, cotton, or a combination of linen and cotton. A cloth under consideration of the latter type, of a good quality, is 18 inches wide and contains 58 ends and 37 picks per inch finished. The yarns in both warp and filling, with the exception of the selvage ends, are single. There are 8 ends of 2-ply yarn for each selvage.

Fig. 4 is the weave used for this cloth; 12 harnesses are required, 10 for ground and 2 for selvages.

For plain white huckaback toweling an ordinary dobby loom is used, one warp beam and one shuttle only being required. Coarse cloth is usually woven on 4 harnesses, with a cross draw.

When colored borders are required a dobby box loom containing a repeater or multiplier motion is the best to use. A fringe motion is added to this when both borders and fringe are required. This motion automatically pulls the cloth forward several inches between each two towels, the distance being regulated as desired.

Carding and Spinning Particulars.

Huckaback towels are made up of various counts of yarns which differ according to the mills in which they are made, and also several grades may be made in a single mill, but the division of mills that they are made in is the second. The fabric under description is made up of 14s warp yarn and 10s filling; the selvage yarns are 2-28s.

THESE YARNS

are all made up of American cotton, the warp and filling yarns being made from a 1 1-16-inch staple and the selvage yarn of 1⅛-staple cotton. The cotton for these mixings is mixed by machine, large mixings being made. They are put through an opener and three processes of picking. Only those openers that have the best means of cleaning the pin beater should be used, as there are several on the market which do not clean the pins properly. Especially is this the case when running sliver waste, the waste becoming wound around the beater, which will be seen to be a great detriment.

THE BEATERS

of all three of the pickers are generally of the two-bladed, rigid type and the particulars given below will be applied to them. The speed of the breaker picker beater for this stock is 1,550 revolutions per minute and the total weight of the lap at the front is 40 pounds or a 16-ounce lap. These laps are doubled four into one at the intermediate picker and pass to the beater, the speed of which is 1,450 revolutions per minute. The total weight

of the lap at the front of this machine is 37½ pounds or a 10-ounce lap. From the intermediate picker the laps are put up at the finisher picker and doubled four into one. The speed of this beater is 1,400 revolutions per minute. The total weight of the laps at the front of this picker is 39 pounds or a 14½-ounce lap. The laps are allowed a variation of one-half a pound either side of the standard weight. When more than this, they are put up at the back and run through the picker again.

WATCH THE EVENER

motion to see that it is working properly. The cotton at the finisher picker receives 42 blows or beats per inch fed. This cotton is generally a very dirty cotton and care should be taken to get all the dirt out possible, so that the cards will not have to do picker work. The laps from the picker are put up at the card, the draft of which is generally not more than 95. The speed of the licker-in is generally 300 revolutions per minute and the top flats make one complete revolution every 50 minutes. The settings of the card should be the same as those given in the article on "Indigo Prints."

THE STRIPPING

should be done three times a day and cards, especially the fronts, should be kept clean. The cards should be ground at least once a month, when the grinding rolls should be allowed to stay on half a day. Always grind lightly, and it is a good plan to have traverse grinding rolls send the grinding disk across the surface of the wire fillet as quickly as possible and not in the slow manner in which it is generally done. Look out for the emery on the grinding disk to see that it does not become greasy. The emery should be cleaned frequently with some fluid that will remove the grease. The

WEIGHT OF THE SLIVER

should be 65 grains per yard and the production for a week of 60 hours 750 pounds. As these yarns are carded they are put up at the drawing frame and run through three processes, the doublings being 6 into 1 at each process. The drawing frames may be equipped with metallic or leather top rolls. If the latter are used, keep the flutes clean; and if the former, see that the top rolls are always well covered and varnished. No matter which top rolls are used, it is important to see that the stop motions are all in perfect working order, especially those operating the spoons, for it is here a great deal of trouble is caused by single and double if they are out of order. The speed of

THE FRONT ROLL

should be about 350 revolutions per minute. The weight of the sliver at the front of the finisher should be 75 grains. This sliver is put up at the slubber and made into .60 hank roving. From the slubber it is put through one process of fly frames for the warp and filling yarns and two processes for the selvage yarn. The hank roving being 2.25 for warp and filling and 1.50 for selvage at the second intermediate, the hank roving for the latter yarn is 5.50. At these frames be sure that the top rolls are in good condition and that the traverse motion is working properly. The top rolls should be cleaned frequently, at least twice a week, and new rolls put in at regular intervals, these being determined by various conditions, which are different in every mill. Never run loose, fluted, bruised or uneven top rolls. Watch to see that all

THE TENDERS

mark their roving correctly and that they do not let single and double go. Do not allow pieces to collect, but use them up as fast as possible. Keep floor of card room clean at all times, as nothing creates so poor an impression on a visitor as an untidy card room floor. From the card room the roving is taken to the ring spinning room and made into 14s warp on a frame having a gauge of three inches; diameter of ring, 2⅛ inches; length of traverse, 7 inches; twist per inch, 17.77, and spindle speed of 9,000 revolutions per minute. The 10s filling yarn is made on a frame having a 2¾-inch gauge, 1⅝-inch diameter ring, 7-inch traverse, 10.28 twist per inch and spindle speed of 6,400 revolutions per

minute. The selvage yarn is spun on a frame having 2¾-inch gauge, 1¾-inch diameter ring, 6½-inch traverse, 25.13 twist per inch and spindle speed of 9,700 revolutions per minute. The warp yarn is put through a spooler and warper and from here put through a slasher. The selvage is put through a spooler and then twisted, spooled again, and run onto a selvage beam after being put through a slasher.

IMITATION GAUZE—Mock Leno

These weaves are very extensively used in cotton manufacture.

The imitation of leno or gauze fabrics can be made extremely close; in some cases the deception has even imposed on experienced buyers.

These weaves are commonly used

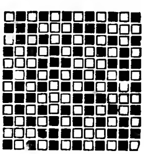


Fig. 1.

for such fabrics as dress goods, curtains, ladies' aprons, men's shirts, canvas cloth, etc. These fabrics are characterized by three or more warp threads and three or more filling picks interlacing with each other very loosely, while the following warp and filling threads form a complete break and so can readily be kept apart for small spaces.

In the warp these breaks are augmented by the reed by leaving one, two, three or more dents empty (if, for example, we use a plain six-harness imitation gauze weave, as shown in Fig. 1, ends one, two and three would be drawn in one dent, while ends four, five and six would fill another dent) and by leaving one, two or more dents empty between the first group of three ends and the second group of three ends. The number of dents to be left empty depends upon the space desired between each group of ends.

Diagram Fig. 2 shows the character of fabric woven with weave shown in Fig. 1.

A four and four, or five and five mock leno is based on the same principle as the three and three described above; in the four and four the ends are reeded four in one dent, while in

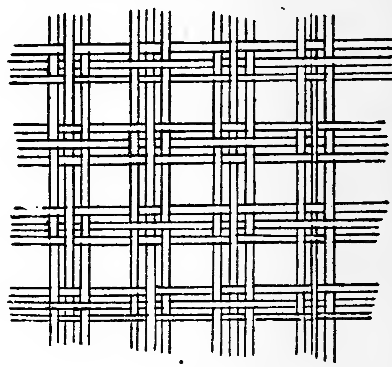


Fig. 2.

the five and five the ends are reeded five in one dent.

The four and four and the five and five end patterns produce a slightly more open effect than the three and three end pattern.

The former is also suitable for a finer make of cloth, as the open effect can be made with a larger number of ends per inch.

In the five and five end or ten-harness weave (see Fig. 3) the second, fourth, seventh and ninth ends serve to pull the picks together in fives and make a decided opening in the cloth between the fifth and sixth picks; in

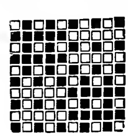


Fig. 3.

the pattern the same thing takes place with the ends—they are pulled together in fives by the second, fourth and seventh and ninth picks, and if two dents be skipped between each group of five ends it will produce the effect

in fabric shown in Fig. 4. In addition to plain gauze fabrics, as shown in Fig. 2, these weaves are used in connection with plain woven fabrics in the form of a pattern (see Fig. 4) and also in the form of checks. The fabric shown in Fig. 4 shows a series of ends working gauze or mock leno throughout the entire pattern, forming a stripe through the entire length of the fabric. In the check effects these ends are made to weave plain or otherwise as may be desired. Fig. 5 illustrates a mock leno three and three check pattern, showing 18 ends working

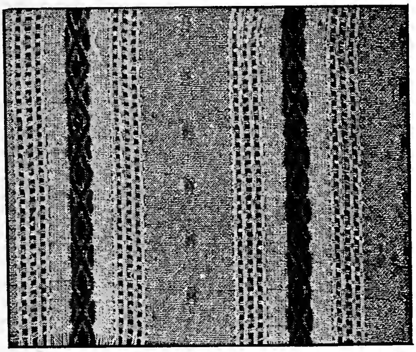


Fig. 4.

gauze from 18 picks and the next 18 ends working plain for 18 picks, these two series of ends alternating into a plain weave at the end of the 18 picks. These check pattern fabrics in nearly all instances are given a wet finish whenever they are woven with bleached and dyed yarn. A great many of these mock leno fabrics are made with grey yarns and finished after the cloth is woven, being bleached and sold in the white state or piece-dyed as the demand requires. Whenever colors are necessary for stripes, yarns which are fast to the bleaching process are used, and in this manner it is possible to make cloth somewhat cheaper than in any other method. A good many fabrics have been made upon this principle where silk is used in combination in the warp and an openwork effect is obtained which can seldom be obtained in any other way in as reasonable a manner.

By reason of the fact that the warp is reeded three in one dent, skipping one, two or more dents between each three ends will cause the plain woven part of the fabric to show more or less streaky; that is, it will show each of the three ends lying close together instead of being evenly distributed across the fabric. When subjected to the wet finish these ends will take their proper places. When making a gauze stripe fabric, as shown in Fig. 4, the ends operating the gauze weave are on a separate beam because of the difference of take-up in warp during weaving.

Another method of producing a mock leno is to have two ends appear as if they were twisted around several other ends, that is, not resting parallel to one another. This is readily produced by allowing the two ends to come together for two picks, then gradually spreading them for six or eight picks, then allowing them to gradually come together again for two picks. These two ends in the pattern are of coarser counts than the body of warp, usually a three-ply thread, and are on a separate beam from the body of the warp.

Fig. 6 shows design and reeding plan for a fabric of the above description.

ANALYSIS.

Width of warp in reed, 37½ inches; width of fabric finished, 36 inches; ends per inch finished, 68; reed, 1,200; take-up of warp (ground warp) during weaving, 10 per cent: take-up of leno warp during weaving, 20 per cent.

DRESSING.

12 ends white.
8 ends blue.
6 ends white.
4 ends blue.
2 ends white.
2 ends blue.
10 ends white.
8 ends blue.
16 ends white.
1 end dark blue mercerized cotton.
8 ends white.
1 end dark blue mercerized cotton.
16 ends white.
8 ends blue.
10 ends white.
2 ends blue.
2 ends white.
4 ends blue.
6 ends white.
8 ends blue.

134 ends in pattern.

Ends in pattern: 88 ends white 40s; 44 ends blue 1-40s; 2 ends dark blue 3-30s; total, 134 ends.

Filling, 70 picks per inch 1-50s bleached cotton.

LOOM REQUIRED.

These fabrics are mostly woven with but one color filling; consequently any ordinary harness loom would answer for weaving these fabrics. Competition and economy are factors that have caused the discarding of the old roller loom, using instead the dobby harness motion loom.

FINISHING.

These fabrics are sometimes given a dry finish, depending chiefly upon the weave and pattern. In some qualities in which only one color warp and filling is used, the fabric is bleached, hot pressed, then made up into rolls ready for shipment. When two or more colors are used, the fabric in most

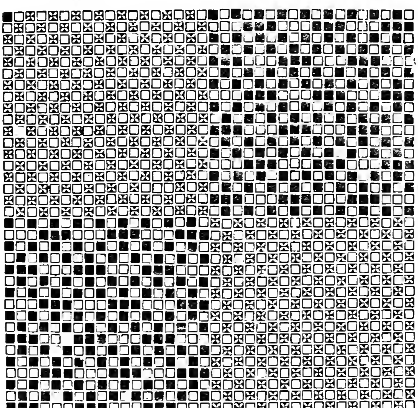


Fig. 5.

cases is boiled off, then subjected to a light sizing, pressed, and then made up into rolls.

Carding and Spinning Particulars.

The yarns of which mock lenos are composed are made up in mills of the second division as given in a previous article. These yarns may be either combed or just carded, according to the grade of the fabric to be made. For the fabric under description in this article we will consider the filling yarn to be combed and the warp yarn to be carded. The filling yarn is made from an American cotton of 1 5-16-inch staple, while the warp yarn is

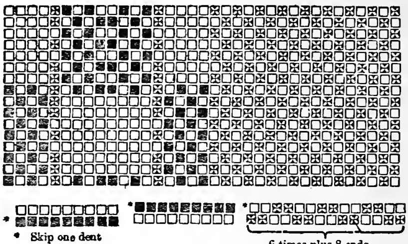


Fig. 6

made out of cotton of 1¼-inch, the cotton used for both purposes being of a good grade. Both cottons are generally mixed by machine, being kept in separate bins, of course. The mixings should be as large as possible. each batch being calculated to last at least a week.

A GOOD PLAN

to follow is to have a batch of the same stock always on hand drying out while one is being used. This insures a dry and fluffy cotton being mixed. At the mixing bins the good sliver waste from all machines up to the slubber is mixed in. This waste should be spread throughout the entire mixing, and not, as is sometimes done, piled up in one place and fed to the opener all at once. The mixing is put through an opener and three processes of picking. Follow the rules that have been given in previous articles in connection with the opener. At the breaker picker the beater used is generally of a two-bladed, so-called rigid type and for both stocks makes 1,500 revolutions per minute. See that the beater is properly set to the feed rolls and that the grid and grate bars are properly spaced so that they will allow all foreign matter to drop through. Look out for all

THE DRAFTS

to see that they are properly directed to the best advantage to make a good,

clean, even lap that does not split. The weight of the lap at the front of the breaker picker is 40 pounds. At the intermediate picker the speed of the beater (two-bladed) is 1,450 revolutions per minute, and the total weight of the lap is 37 pounds or a 12-ounce lap for the 1 5-16-inch stock and a 10-ounce lap for the 1¼-inch stock. These laps are doubled four into one at the finisher picker. On this picker the speed of the beater is also 1,450 revolutions per minute. The total weight of the lap at the front is 35 pounds for the 1 5-16-inch stock and 39 pounds for the 1¼-inch stock, or a 13-ounce lap for the longer stock and a 14½-ounce lap for the shorter staple. The laps are put up at the card and the draft of the card for the warp yarn is not more than 95. The speed of the licker-in should be about 300 revolutions per minute. The top flats make one complete revolution every 50 minutes. The sliver weighs 65 grains per yard and the production for a week of 60 hours is 750 pounds. For the filling yarn the draft of the card should not be less than 110. The top flats make one complete revolution every 35 minutes, the speed of the licker-in being 300 revolutions per minute. The weight of the sliver is 55 grains per yard and the production 550 pounds for a week of 60 hours. The counts of the wire fillet used for all parts would be similar for carding both staples of cotton or 110s for cylinder and 120s for doffer and top flats. Strip three times a day and grind at least once a month. Always gauge the setting points after grinding and set to high places. Use

THE SETTINGS

given in a previous article on "Bedspreads." The sliver for the warp yarn is put through three processes of drawings, the doublings being 6 into 1, the speed of the front roll being 350 revolutions per minute at each process. A good weight for the sliver at the different processes is as follows: 77 grains at front of breaker, 76 grains at front of middle and 70 grains at front of finisher. Either metallic or leather-covered top rolls may be used on this stock. Either one used will give good results if properly cared for. If leather-covered rolls are used, use one of the recipes given in a previous article and don't use rolls that are not in perfect condition. If the damage is in the covering, send it to be recovered and always examine the returned rolls to see that they are level and have the right grade of sliver covering. Look out for all the knock-off motions to see that they are in perfect working order; for remember that one of the two duties of a drawing frame is to even the sliver, and if the knock-off motions do not work they will allow single to go through, which is a serious fault that is not corrected while passing through the slubber where the end is put through single. The drawing sliver is put through the slubber and drawn into .60 hank roving. From here it passes through two processes of

FLY FRAMES,

the hank roving at the first intermediate being 2 for the 30s, and 2½ for the 40s yarn; at the second intermediate the hank roving is 6 for the 30s and 8.50 for the 40s yarn. These rovings are then spun on a ring frame into 30s and 40s yarn. For 30s yarn the frame, to get best results, should be fitted as follows: Gauge of frame, 2¾ inches; diameter of spindle, 1¾ inches; length of traverse, 6½ inches; twist per inch, 26.02, and spindle speed, 9,800 revolutions per minute. For 40s yarn use a 2¾-inch gauged frame, a 1⅝-inch diameter ring, 6½-inch traverse, 28.46 twist per inch and spindle speed of 10,000 revolutions per minute. The yarns are spooled and twisted, 3 ends of 30s being twisted together, and then 2 ends of the 3-30s twisted with 1 end of the 40s yarn. The yarns are then warped and slashed.

The card sliver for the filling yarn is generally put through a sliver lap, ribbon lap and then a comber. At the sliver lap the doublings are 14 into 1, the weight of a yard of lap being 280 grains per yard. These are doubled at the ribbon lap machine 6 into 1. The weight of the laps at the front of this machine is 265 grains per yard. These laps are put up at the comber and

doubled according to the number of heads on the comber, either six or eight into 1. The particulars given for the sliver and ribbon lap machines are for an $8\frac{3}{4}$-inch lap.

AT THE COMBER

a percentage of 16 per cent should be taken out of the lap being fed. The settings should be the same as given in a previous article and this is true of the trimmings. As the combers are not equipped with stop-motions, single and double should be looked for, and it is a general rule, if two or more ends break down on the table, to break the sliver entering the can and to remove all single from can before piecing up end again. This rule should be rigidly enforced so as to prevent, as far as possible, single going to the drawing frame. Keep the leather detaching rolls in perfect condition as to covering and varnish. It is a good plan to varnish all detaching rolls at least once a week. Varnish leather-covered rolls in draw box as often as necessary. Take percentages of at least six combers a day to see just what they are doing. The comber sliver is put through two processes of drawing. The speed of the front roll at each process is 350 revolutions per minute. A good weight for the sliver is 68 grains per yard at the breaker and 75 grains per yard at the finisher. The sliver is then put through the slubber and made into .50 hank roving. From here it is put through three processes of fly frames, the hank roving at each process being as follows: First intermediate, 1; second intermediate, 3, and fine 12 hank. This roving may be either mule or ring spun. If the latter, use a frame with the following particulars: Gauge of frame, $2\frac{3}{4}$ inches; diameter of ring, 1¼ inches; length of traverse, 5½ inches; twist per inch, 26.52, and speed of spindle, 8,200 revolutions per minute. The yarn is then taken and conditioned and is ready for weaving.

Dyeing Particulars.

AMBER.

One-half per cent diamine catechine G.; 15 per cent Glauber's salt; 1 per cent sal soda; after-treat with ½ per cent bichromate of potash; ½ per cent sulphate of copper.

SKY BLUE.

One-half per cent diamine sky blue FF.; 15 per cent Glauber's salt; 1 per cent sal soda; after-treat with ½ per cent sulphate of copper.

LIGHT PEA GREEN.

Six ounces diamine sky blue FF.; 8 ounces diamine fast yellow FF.; 10 pounds Glauber's; 1 pound sal soda, after-treat with 1 per cent sulphate of copper.

PINK.

One-half per cent erika pink G.; 10 per cent Glauber's salt; 1 per cent sal soda.

LIGHT SLATE.

Four ounces benzo fast black; 1-16 ounce chrysophenine; 5 pounds Glauber's salt; ½ pound sal soda.

PEARL.

Four ounces naphthamine black N.; 5 pounds Glauber's; 1 pound sal soda; after-treat with ½ pound bichrome.

NAVY.

Four per cent naphthamine blue 2 B.; 20 per cent Glauber's; 2 per cent sal soda; after-treat with 1 per cent bichrome; 1 per cent sulphate copper.

NAVY BLUE.

Two per cent diaminogene blue BB.; 2 per cent diaminogene blue NA.; 25 per cent Glauber's salt; 3 per cent sal soda.

Diazotize: Two and one-half per cent nitrite soda; 5 per cent sulphuric acid; turn for fifteen minutes and rinse.

Develop: Dissolve 14½ pounds beta naphthol; 18 pounds soda lye at 77 degrees Tw.; 20 gallons boiling water; for 100 pounds yarn add 1½ gallons of developing solution, turn for 15 minutes, rinse and give a good soaping.

RED.

Six per cent primuline; 20 per cent Glauber's; 2 per cent sal soda; diazotize and develop as the navy blue.

LIGHT YELLOW.

Four ounces chromine G.; 5 pounds salt; 1 pound sal soda.

GREEN.

Three per cent diamine green G.; 3 per cent diamine fast yellow A.; after-treat with 3 per cent bichrome.

BLACK.

Fifteen per cent immedial black NN.; 15 per cent sulphide sodium; 3 per cent soda ash; 30 per cent Glauber's salt.

FILLING REVERSIBLES

Filling reversibles is a term given to a class of cotton fabrics used extensively in the manufacture of dressing sacques, kimonos, bath robes, etc. In cotton warp and shoddy or woolen filling goods the same principle of construction is adopted for goods for horse blankets, rugs, etc.

THE RESULT DESIRED

is to have a cloth containing two colors, each color being in solid blocks or effects, and to have one side the reverse of the other. In low-price goods this is obtained by a combination of weave, color and finishing.

Fig. 1 illustrates a cloth of this type showing solid blocks of brown and white running warp way. Where brown appears on the face, white appears opposite on the back. In this particular sample the white bar across the cloth shows white on both sides. Brown shows opposite white at all other places.

Fig. 2 illustrates the weave for cloth Fig. 1, being on 80 ends and 96 picks. Sections A correspond to brown sections on the face of the cloth, and sections B, indicated on picks marked white, to the white sections. The weave is really complete on eight picks, the coloring indicating the extent of the pattern.

In Fig. 2 the dots indicate the face weave, i. e., at these places the filling which is always considerably coarser than the warp, almost covers the latter. On account of the large number of picks, as compared to warp, the relative sizes of the yarns and the peculiarity of the weave, the filling on the picks indicated by the dots comes together, covering the picks indicated by the crosses. The picks marked in crosses come together on the under side of the cloth.

In the section bracketed and indicated as containing 80 picks, the filling is picked two brown and two white alternately, making 40 brown picks on the face and 40 white picks on the back in sections A and the reverse colors in sections B. The fabric is really double in the filling and single in the warp.

Sections A form a left-hand twill on the face and a right-hand twill on the back; sections B vice-versa. The construction of the fabric under consideration is 42 ends and 62 (31 face and 31 back) picks per inch finished. The warp is 15s and the filling 7½s. The latter contains very little twist. The warp is all white. The filling is two brown and two white for 80 picks, 16 white; total, 96 picks per pattern. The width is 27 inches finished. The harness draft requires eight harnesses, four for sections A and four for sections B, in addition to two for selvages. Reed 2 or 4 ends per dent. The chain draft is shown in Fig. 3. The box chain would be re-

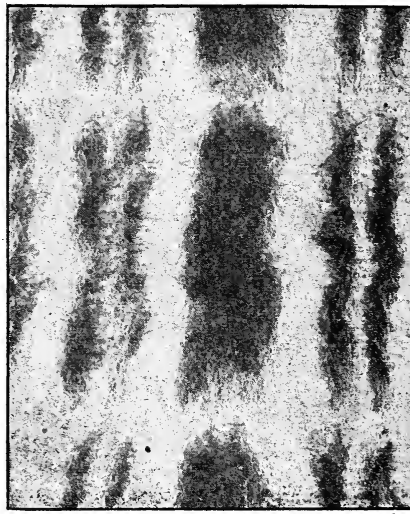


Fig. 1.

quired to be built for 96 picks, and a loom with a repeater or multiplier motion would be the best to use.

LOOM REQUIRED.

The simpler types of filling reversi-

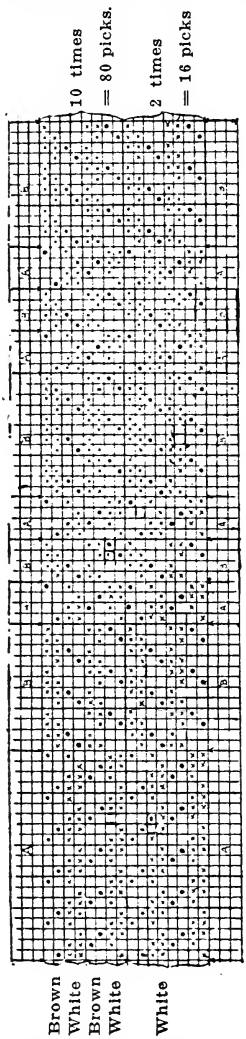


Fig. 2.

bles can be woven readily on any ordinary dobby loom arranged with a two by one box motion. As the warp is hidden entirely after finishing, one warp only is required. On account of the coarseness of the filling, large shuttles are necessary. For rugs a jacquard head is usually used.

FINISHING.

Practically all the finishing these goods receive is in raising the fibre to form a nap. This nap entirely obliterates the weave effect. The soft-twisted filling is readily raised by the card wire of the cotton raising machines.

Carding and Spinning Particulars.

The mills that make the yarns of which filling reversibles are made will be found in the first and second division of mills as given in a previous article. The filling yarn is slack twisted, and for the fabric to be described is a number 7½ yarn. This is made from various stocks; sometimes only straight cotton is used, but more generally it is composed of a certain per-

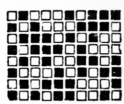


Fig. 3.

centage of waste, sometimes as high as 60 per cent waste being used.

THE WASTE

used also differs, some using cards, some comber and some both. It is generally safe to say if waste is used that it will be card waste, for the mills making this class of goods are not generally equipped with combers. The stock with which the waste is mixed is of from ¾ to 1 inch staple, according to the quality of the fabric required. A fine average staple to take is one of ⅞-inch length. The mixing would be done by hand, and it is almost needless to state that large mixings should always be made for various reasons that have been given previously. The stock of which the warp yarn is made is ⅞ to 1 inch in length, generally the former length being used. While the stock for this yarn is sometimes mixed with waste, the percentage of waste does

not run as high as that used for the filling stock. The stock is put through three processes of picking, before which it passes through an opener. Keep the hopper of this opener well filled with cotton so that the fitting or spiked apron will always have a full load. The beaters generally used for the pickers for this class of goods are of the two-bladed, rigid type and the speed of that in the breaker picker should be about 1,550 revolutions per minute. The weight of the lap at the front should be 40 pounds or a 16-ounce lap. These laps are doubled four into one at the intermediate picker. The speed of this beater for both warp and filling yarns is 1,500 revolutions per minute. The

WEIGHT OF THE LAP

at the front of this picker is 38 pounds or a 14-ounce lap. These laps are doubled at the back of the finisher picker four into one. The speed of this beater is 1,500 revolutions per minute, which gives the cotton passing through about 43 beats per inch. The total weight of the lap at the front of this machine is 39 pounds or a 14½-ounce lap. A variation of one-half pound either side of standard weight for lap is allowed. Those having more of a variation than this are put at the back of the finisher picker and run over again, although care should be taken not to run two of these laps at the same time, for this would be more than apt to throw the weight of the lap being made out. Look out for the direction of the air currents and see that an

EVEN AND UNIFORM LAP

is being made at the front. Do not fool with the lap weight adjustments too much, for too much is worse than not enough, for the former will keep the weight of the lap jumping all around, whereas the latter is more apt to get the same weight of laps. These laps are put up at the card where the draft should not be more than 90. The settings of the card used should be the same as those given in connection with the article on indigo prints, except that of the feed plate to the licker-in, which should be set just a trifle farther, longer than the length of the staple. The flats and doffer should be covered with No. 34s wire and the cylinder No. 32s wire fillet. The speed of the licker should be 350 revolutions per minute, while the flats should make one complete revolution every 55 minutes. The cards should be stripped at least

THREE TIMES A DAY

and an extra stripping would greatly improve the yarn, but is not generally done. The weight of the sliver is 65 grains per yard and the production is 975 to 1,050 pounds per week of 60 hours. This sliver is next put through two processes of drawing where the doublings are 6 into 1. The speed of the front roll is 400 revolutions per minute for each stock, the draft of the breaker frame is 5.25, the weight of the sliver being 72 grains. The draft at the finisher is 5.60, the weight of the drawing being 72 grains per yard. For this class of work either leather-covered or metallic top rolls may be used. But the metallic top rolls are considered by many to have a great many advantages, one of the principal ones being that more production is turned out with the same speed of roll. No matter which top roll is used, they should be watched carefully to see that they are in perfect condition

FOR MAKING GOOD WORK.

It is also a good policy to watch the stop-motions, for it is these, if they are not in proper working order, that cause single to be made. The sliver for the filling yarn is made into .40 hank slubber roving, while that for the warp yarn is made into .50 hank roving. The filling yarn is put through one more process of fly frames and made into 1 hank roving, which is taken to the mule room and spun into 7½s, having a 2.80 twist per inch. The slubber yarn for the warp yarn is put through two processes of fly frames, at the first being made into 1 hank and at the second into 3½ hank. This yarn is then taken to the ring spinning room and spun into 15s on a frame having a 3-inch gauge: 2⅛-inch diameter ring; 7-inch trav-

erse, 18 turns per twist and a spindle speed of 9,200 revolutions per minute. This yarn is then spooled, warped and then put through a slasher.

Dyeing Particulars.

HAVANNA BROWN.

Three per cent immedial brown RR.; 3 per cent immedial cutch O.; 6 per cent sulphide sodium; 30 per cent Glauber's salt; 3 per cent soda ash.

NAVY BLUE.

Eight per cent pyrol navy blue; 8 per cent sodium sulphide; 3 per cent soda ash; 25 per cent salt.

BOTTLE GREEN.

Ten per cent pyrol green B.; 10 per cent sodium sulphide; 3 per cent soda ash; 25 per cent salt.

PEARL.

One-half per cent immedial black N R T.; 5 per cent salt; 1 per cent sodium sulphide; 2 per cent soda ash; 10 per cent salt.

SKY BLUE.

One per cent tetrazo brilliant blue 6 B.; 2 per cent sal soda; 20 per cent Glauber's salt.

RED.

Five per cent primuline Y.; 2 per cent sal soda; 20 per cent Glauber's.

Diazotize: 2½ per cent nitrite soda; 5 per cent spirits salt.

Develop: 2 per cent beta naphthol 2 per cent soda ash.

SLATE.

One per cent immedial black N B.; ¼ per cent immedial direct blue B. 20 per cent salt; 2 per cent soda ash; 2 per cent sulphide soda.

ECRU.

One-half per cent immedial yellow D.; ½ per cent immedial cutch G.; 1 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

BROWN.

Eight per cent katigen brown V.; 8 per cent katigen yellow G G.; 10 per cent sodium sulphide; 2 per cent soda ash; 30 per cent Glauber's salt.

HELIOTROPE.

Eight per cent thiogene violet B.; 8 per cent sulphide sodium; 2 per cent soda ash: 30 per cent Glauber's salt.

BLACK.

Ten per cent immedial black N N.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

PINK.

One per cent Erika pink; 3 per cent sal soda; 20 per cent salt.

DHOOTIES

Dhootie cloths are a class of fabrics used very extensively in Zanzibar, Africa, Egypt and India, for scarfs, turbans, and girdle or body cloths.

They vary in width from 18 inches to 50 inches, and in length from two to six yards. The cut lengths vary from 12 to 40 yards.

They are distinguished by gaudy, highly colored borders, running lengthwise, and headings running across the piece between which both warp and filling yarns are of gray white or other light color. Both sides of the cloth are similar, the fabric being reversible. The borders lengthwise range from about one-half inch to four inches in width.

THE REAL DHOOTIE

is a native eastern hand-woven fabric, in which the colored filling interlaces only with the border warp yarns. To weave such a fabric the services of three persons are required, one to take care of the center and one for each of the borders.

It is practically the only article of apparel used by many of the poorer classes in the eastern countries.

Referring to these goods an Indian textile journal states that the following are standard sizes: 22 inches to 23 inches wide, 2 yards long; 24 inches to 25 inches wide, 2½ yards long; 26 inches to 28 inches wide, 3 yards long; 29 inches to 32 inches wide, 3½ yards long; 29 inches and upwards wide, 4 to 5 yards long.

THE YARNS

employed vary from 30s to 40s in the warp, and from 36s to 60s in the filling.

A great many of the goods are made with 34s warp and 40s filling in the center of the goods, the borders being about 2-50s and 2-60s.

Although not usually the case, they are sometimes made with several colored stripes in the width of the piece, in addition to those forming the borders.

The cross borders, or headings, are sometimes very elaborate, varying in length up to about 20 inches. In the longer types these headings are inserted every few inches, whereas in the shorter types they are woven only at the beginning and end of each scarf. The

BORDERS AND HEADINGS

are intended to be made so that the colors of which they are composed will appear as prominent or solid as possible. To accomplish this on the side borders the method usually adopted is to arrange the colors in the war yarns, and crowd them in the reed so that they will cover the filling as nearly as possible. In this class of dhooties the filling is of the same colo as the warp of the center of the goods. This filling necessarily shows to a greater or less degree in the borders and is regarded as an objectionable feature.

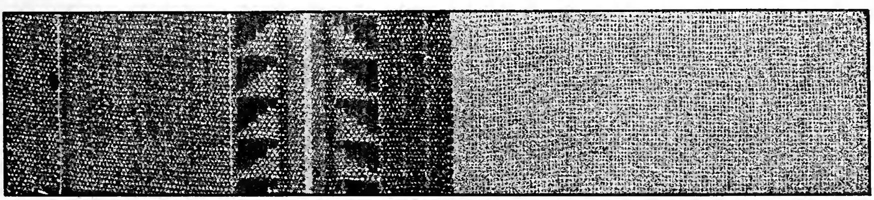
When weaving the better grades of goods, those nearly approaching in appearance the native hand-made goods, another method is adopted to make the prevailing color in the borders, usually red, as bright as possible. They are made on a loom containing three shuttles, one of which is a fly shuttle and carries the filling fo the centers of the cloth; the other two are small shuttles, made to work on one of the positive motion principles, as on narrow ware looms. These two shuttles

WORK ON OPPOSITE SIDES

of the loom and interweave only with the warp yarns constituting the borders. The small shuttles cross the ends at the same time as the fly shuttle, so that the amount of production is not affected either way by them.

Three filling forks are used, one for each shuttle, so that if any of the fillings break, the loom is stopped instantly.

The border shuttles run in a different plane, and move in the opposite direction to the fly shuttles, so that only one pick of filling passes in front of the filling forks on the pick required to actuate the stop-motion. Catch threads are used to connect the borders and centers.



When the goods are required to b made with colored headings, the bo motion of the loom is actuated to insert different colors of filling as may be necessary, the loom weaving th cross borders, or headings, and center automatically. If a fringe is desire it is made in the usual manner.

The figure illustrates one border and part of the white center of cheap dhootie cloth, in which the white filling interlaces with both center and border.

The border is 2 5-16 inches wide and contains five colors, red, green, yellow, white and orange. The outer stripe of red is 1 3-16 inches wide The count of the center cloth is 52x 46, and is reeded two ends per dent. The fancy weave portion is arranged one end of green and one end of red, alternately, and is reeded five ends per

dent. The remainder of the border is reeded four ends per dent. With the exception of the 32 ends working as extra warp the weave of the fabric is plain. Eight white ends working as four divide the border from the center. The border ends are ply yarns. The center ends and the filling are single.

LOOM REQUIRED.

For plain dhooties, in which the borders as well as the centers weave plain, an ordinary single box loom is used, unless cross borders are required, when a box motion becomes necessary. In England, where these goods are extensively manufactured, side cam, revolving box looms are usually used.

For the better grades, where the borders are interlaced with colored and the centers usually with white or gray filling, a loom of a special type previously referred to as having positively acting and fly shuttles is used. This contains a dobby or other head motion.

Whether for low or high grades plain or fancy, the border warp yarns are usually run from small rollers or spools, on account of being reeded differently, and are often of different counts from the center yarns.

Carding and Spinning Particulars.

The yarns of which dhooties are made would be manufactured in mills having the equipment of machinery found in the second division of mills as given in a previous article. The dhootie which is taken for an example will be supposed to be composed of 34s warp and 40s filling for the center and 2-60s for the borders. These yarns are made from the following cottons: The 2-60s is made from 1⅜-inch American cotton and is combed. The 40s and 34s are made from a 1 3-16-inch staple American cotton and may be

EITHER COMBED OR CARDED.

For this article we will consider that they are carded, but as it is desirable that the yarn shall be as free as possible from neps, the speeds and settings of the card will be different from those generally used for this count of carded yarn. All three cottons may be either mixed by hand or by machine; the advantages of machine mixing (by means of a bale breaker) have been already previously given. Each mixing should of course be in separate bins and as large as possible so as to cause as little variation as possible in the finished yarn. It is also an important point to see that the different bales are intermixed. The cottons are put through an opener and three processes of

PICKING MACHINERY.

The good waste is mixed in with the raw stock as it is collected, but care should be used to scatter the waste, so that it will be evenly divided all over the mixing. The hopper of the opener should be kept full of raw stock all the time for reasons given in previous articles. The cotton should leave the opener and be delivered on the lattice apron of the breaker in a fluffy state, and if the hopper has been kept full all the time it will also be fairly even, i. e., if each yard of cotton passed to the feed roll is weighed, a great deal of variation will not be found. The beaters of the pickers used for this class of goods are generally of the rigid, two-bladed type, although a great many are using the pin beater. When the latter is used, it does not require as high a fan speed as the rigid form of beater. This is due to its wide arms, and as it has three of these, it makes

CONSIDERABLY MORE DRAFT

than the two-bladed type of beater.

The speed of the beater for 1 3-16-inch stock for this class of goods is 1,550 revolutions per minute, and for the 1⅜-inch stock is 1,450 revolutions per minute. The total weight of lap at the breaker is 40 pounds for all staples or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. The speed of the beater of this machine is 1,475 revolutions per minute for 1 3-16-inch stock and 1,425 for 1⅜-inch stock. The total weight of the lap is 37½ pounds or a 12-ounce lap for 1⅜-inch stock,

and a 10-ounce lap for 1 3-16-inch stock. These laps are put up at the finisher picker and doubled as before, 4 into 1. The speed of this beater is 1,475 revolutions per minute for 1 3-16-inch staple, and 1,400 revolutions per minute for 1⅜-inch staple. The total weight of the lap is 39 pounds for 1 3-16-inch staple stock and 35 pounds for 1⅜-inch staple. A variation of half a pound either side of standard weight is allowed. All finished laps that vary from their standard weight more than this are put back and run through the finisher picker again. At this machine the cut-roving waste is also mixed in. Sometimes this is done by taking out two laps at the back, the two middle ones, and the cut waste spread evenly over the space thus made. It is

A BETTER METHOD

to use a roving waste picker, as then all the twist is taken out of the roving. After passing through this roving picker the cotton is made into a lap at the breaker or intermediate machine, and is then put through the finisher picker, when it is used as follows: three laps of raw stock to one lap cut-roving waste. The weight per yard at the front of the finisher picker is as follows: for 1⅜-inch stock 12½ ounces; for 1 3-16-inch stock, 14 ounces per yard. The cotton next passes to the card. The cards for all lengths of staples will be set alike for reasons previously given. Set doffer to cylinder with 5-1,1000ths-inch gauge. Set under screen as follows: at licker-in with 12-1,000ths-inch gauge middle to 34-1,000ths and front ¼ of an inch. Licker-in to cylinder with 7-1,000ths of an inch. Licker-in screen to licker-in, 3-16ths of an inch. Set bottom licker-in knife with 5-1,000ths gauge, top knife to 10-1,000ths of an inch gauge. Set feed plate to licker-in to 7-1,000ths of an inch gauge, and top flats to 12-1,000ths of an inch gauge. The speed of the licker-in should be 300 revolutions per minute. The flats make one complete revolution every 40 minutes for all stock. The production should be 500 pounds for 2-60s yarn and 600 pounds for the other yarns. Cards should be stripped three times a day and ground at least once a month and then the grinders should be allowed to stay on at least half a day. The cards should be reset after grinding. Special care should be taken to see that the top flats are sharp and are ground evenly and do not have more taken off the toe than the heel, as is generally the case unless great care is taken. The weight of the sliver is 50 grains per yard for each staple. After passing the card

THE PROCESSES

of the stocks differ. We will first follow the course of the carded staples. These are put through three processes of drawing, the front roll speed at each process being 350 revolutions per minute. The weight of the sliver at the front is 70 grains per yard. Great care should be taken to see that the stop-motions are in perfect working order, otherwise a great deal of trouble will result in single and double. At the slubber the sliver is made into .60 hank roving. This roving is then put through two processes of fly frames. At the first intermediate it is made into 2 hank roving and at the second into 7 hank for the 34s warp and 8 hank for 40s filling.

The card sliver for the 2-60s yarn is combed and the general sequence of processes is as follows: Sliver lap machine, where it is doubled 14 into 1 and has a draft of about 2; a yard of lap at the front weighing 300 grains per yard for an 8¾-inch lap. Six of these laps are put up at the ribbon lap machine and made into a 260 grain lap at the front. Keep top leather rolls in good condition and well varnished. Six laps from the ribbon lap machine are put up at the comber, if it is a six-head machine, or eight laps if it is an eight-head machine, and the weight of the finished sliver is 45 grains per yard. The

SPEED OF THIS COMBER

is 90 nips per minute, the per cent of waste taken out being 16. Keep the detaching rolls well varnished, recipes for which have been given in previous articles as well as a means for keeping the laps of the leather from splitting. After passing the comber the

sliver is put through two processes of leather-covered top roll drawing frames, the doublings being 8 into 1 at the breaker and 6 into 1 at the finisher. The weight of the sliver at the finisher drawing is 70 grains per yard. This is made into .50 hank roving at the slubber and is then put through three processes of fly frames, the hank roving at each being as follows: First, 1 hank; second, 3½ hank, and fine frame, 12 hank. This is then taken to the ring spinning room and spun into 60s on a frame with a 1¾-inch diameter ring, 5-inch traverse, and a spindle speed of 8,000 revolutions per minute; after which it is doubled into 2-60s. The roving for the 40s filling is spun on a ring frame having a 1⅝-inch diameter ring, 5½-inch traverse and a spindle speed of 8,800 revolutions per minute, and then spooled and warped and put through a slasher. The roving for warp is spun into 34s on a warp spinning frame with a 1⅝-inch diameter ring, 6½-inch traverse, and a spindle speed of 10,200 revolutions per minute, after which it is taken to the conditioning room.

Dyeing Particulars.

BLUE.

Three per cent immedial indone B.; 2 per cent immedial indone 3 B.; 5 per cent sodium sulphide; 2 per cent soda ash; 30 per cent Glauber's.

GREEN.

Five per cent immedial yellow D.; 5 per cent immedial indone B.; 10 per cent sodium sulphide; 3 per cent soda ash; 30 per cent Glauber's.

RED.

Six per cent primuline; 30 per cent Glauber's; 2 per cent sal soda, rinse; diazotize: 2½ per cent nitrite soda; rinse; develop: 2 per cent beta naphthol, rinse and soap at 150 degrees F.

YELLOW.

Mordant with tannine and tartar emetic, rinse; dye with 3½ per cent thioflavine T. and rinse.

LIGHT GREEN.

Dye yellow with thioflavine T.; and dye on top with 2 per cent brilliant green Y.; rinse and give a weak soaping.

ORANGE.

Dye with 6 per cent primuline; after-treat with ½ degree Tw. solution of chloride of lime.

LIGHT BROWN.

Four per cent thion orange N.; 4 per cent sulphide soda; 2 per cent soda ash; 30 per cent Glauber's salt; after-treat with 2 per cent sulphate of copper.

MYRTLE GREEN.

Eight per cent thion green G.; 2 per cent thion yellow G.; 2 per cent thion green B.; 10 per cent sulphide soda; 3 per cent soda ash; 25 per cent salt.

WINE.

Eight per cent thiogene red O.; 8 per cent sulphide soda; 3 per cent soda ash; 25 per cent salt.

BLUE BLACK.

Ten per cent immedial brilliant black B.; 10 per cent sulphide soda; 3 per cent soda ash; 25 per cent salt.

UNEQUALLY REEDED STRIPES

Under the above heading may be included an extensive type of cotton fabrics, variously known as satin or sateen stripes, doria stripes, etc.

They are made in all grades, from medium to fine, and used for many purposes, such as dress fabrics, curtain hangings, etc., and are usually shown in all white or solid colors.

They are characterized by prominent stripe effects which appear to stand up from the ground of the cloth.

The raised stripes are produced by crowding more ends in a given space than are contained in an equal space occupied by the ground ends and by weaving them differently. As a rule the yarns forming the raised stripes are woven in satin or twill order, warp flush weaves, while those forming the ground weave plain.

Theoretically, warp ends weaving plain should take up or contract in length faster than ends weaving twill or satin, on account of the greater num-

ber of interlacings. This applies to cloths in which each dent contains the same number of ends throughout the entire width of cloth.

It has been found in practice that when weaving a fabric containing sections reeded, say, two ends per dent, and others four or five ends per dent, the yarns that are crowded in the reed will contract more than those reeded two ends per dent. For example, a

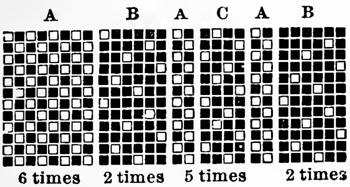


Fig 1.

warp stripe interlaced five ends satin order and reeded five ends per dent would contract in length about as fast as the yarns weaving plain in the same fabric, if the latter were of the same counts of yarn and reeded two ends per dent. This fact explains the reason why satin stripe fabrics are usually woven from one beam.

A characteristic weave is shown in Fig. 1.

The warp layout of one repeat of the pattern is as follows:

Ends.	Dents.	Harnesses.
48	24	1 to 6
12	2	7 to 12
2	1	1 and 2 } 5 times.
4	1	13 to 16 } 5 times.
2	1	1 and 2
12	2	7 to 12

Selvages on harnesses 1 and 2.

The chain draft is shown in Fig. 2.

In Fig. 1 sections A weave plain, sections B weave 6 end warp satin, and sections C weave broken crow, warp face.

When combining weaves in this manner one of the principal points to consider is to bring the warp float of one section opposite the filling float of the adjoinng section, or, as it is termed, they should be made to "cut" each other as well as possible. When this is done, the stripes have a more distinct and cleaner cut appearance than when it is ignored.

The construction data of the sample under construction are: warp, 45s; filling, 40s Egyptian; finished width, 28 inches; width in reed, 29.9 inches; ends in warp, 2,856; sley reed, 76. This represents the proportional number of ends per inch in the plain section. Average sley, 102. This indicates the average number of ends per inch in the entire width of cloth. Picks per inch, 80.

These goods may be woven on a single box dobby loom, the warp yarns being of one count, and one filling only being required.

The fabrics are found in many variations of patterns and qualities, and are subjected to suitable methods of finishing, according to the use to which they are intended to be put.

Carding and Spinning Particulars.

The mills that make unequally reeded stripes are found in the second division, and while the count of yarn varies to a great extent for this class of goods, a good average count would be 45s warp yarn and 40s filling. It is not our intention to say much about the cotton warp yarn otherwise than a few general remarks, i. e., that the yarn is of 1⅛ to 1 3-16-inch American stock and carded, the hank rovings being as follows: for slubber .55 hank,

Top.

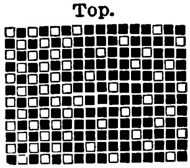


Fig 2.

first intermediate, 2.50, and for the fine fly frame, 10 hank, and is ring spun into 45s yarn. Further particulars for making this count of yarn may be found in previous articles dealing with the same length of stock and making counts of yarn from 35s to 50s. In this article it is our intention to deal with

THE FILLING YARN

which is made from Egyptian cotton of 1⅝-inch staple. On account of its peculiar nature Egyptian cotton is es-

pecially adapted for filling yarns and it is a general custom to make the filling yarns of this kind of cotton, although it is not done in all styles of fabrics, and while the filling yarns of fabrics previously described might equally as well have been made out of Egyptian cotton, still for some special reason the kind of cotton given for filling yarns has been selected. The Egyptian bale is about 300 pounds heavier than the American bale, so that so large a number will not be required in the mixing, which may be done by hand or by the use of a bale breaker. It will also be found that Egyptian cotton is much more easily handled than other kinds of cotton. By this we mean that it gives less trouble to operate it at the different processes. The mixing should be made in the same manner as described in previous articles. The cotton for this stock is put through three processes of picking and an opener. The beater used at each process is generally the two-bladed, rigid type. The

SPEED OF THE BEATER

at the breaker picker is 1,450 revolutions per minute; at the intermediate picker 1,375 revolutions per minute, and at the finisher picker 1,200 revolutions per minute. The total weight of a lap at the breaker picker is 40 pounds or a 20-ounce lap; at intermediate picker, 38 pounds or a 12-ounce lap, and at the finisher picker, 35 pounds or a 12½-ounce lap. The instructions given in previous articles for picking should be followed. At the card the draft for this stock should not be less than 120. The flats should make one complete revolution every 30 minutes, and the speed of the licker-in should be about 300 revolutions per minute. The weight of the sliver at the front should be 45 grains and the production for a week of 60 hours should be not more than 500 pounds. The setting points should be set to the same gauges as given in last article, while the particulars given for grinding, cleaning, stripping and oiling that have already been given for the same length of staple of American stock may be used. Egyptian cotton is easily combed and, as one overseer puts it, might be combed with a rake; still considerable care should be given to it to see that it is properly done. The particulars for sliver lap machine, ribbon lap machine and six-head comber for an 8¾-inch lap are as follows: Sliver lap machine doubles 14 into 1 and weight per yard of lap is 295 grains; at the ribbon lap machine the doubling is 6 into 1, the weight per yard being 260 grains; at the comber the doubling is 6 into 1, the weight of the sliver is 47 grains. The percentage of waste taken out at the comber for this stock for fabric named is 16. Use settings and turnings given in a previous article.

THE COMBER SLIVER

is next put through two processes of drawing, the weight per yard at the front being 70 grains per yard with doublings of 6 into 1 at each process. Use either metallic or leather-top covered rolls, this stock running equally well on each. At the slubber the sliver is made into .50 hank roving and from here it passes through three processes of fly frames, the hank roving at each being as follows: First intermediate, 1 hank; second intermediate, 3 hank, and fine frame, 10 hank. The twist gear used at each process should be one tooth smaller than that used for the same hank of roving made from American cotton. Watch the rolls, both top and bottom, to see that they are properly set. After leaving the fine frame the roving may be either mule or ring spun, sometimes one and sometimes the other being preferred for certain reasons. For this fabric the roving is generally ring spun. For spinning 40s filling yarn of 1 5-16-inch staple Egyptian cotton use a frame with a 2¾-inch gauge, 1½-inch diameter ring, and a 5½-inch traverse, and spindle speed of 8,800 revolutions per minute.

Dyeing Particulars.

PEARL.

Four ounces immedial black NRT.; ½ per cent sulphide sodium; 1 per cent soda ash; 10 per cent Glauber's.

SLATE.

One per cent diamine black BH.; 4 ounces diamine fast yellow B.; 1 per

cent sal soda; 20 per cent Glauber's salt.

FAWN.

One per cent diamine fast yellow B.; 4 ounces diamineral brown G.; ½ ounce diamine brown B.; 1 pound sal soda; 20 per cent Glauber's.

SCARLET.

Five per cent diamine scarlet B.; 2 per cent sal soda; 30 per cent Glauber's.

RED.

Four per cent diamine fast red F.; 2 per cent sal soda; 30 per cent Glauber's.

MYRTLE GREEN.

Four per cent benzo green GG.; ½ per cent chrysophenine; ½ per cent benzo fast black; 3 per cent sal soda; 30 per cent Glauber's.

HELIOTROPE.

Two per cent tetrazo lilac B.; 2 per cent sal soda; 25 per cent Glauber's.

LIGHT BROWN.

Two and one-half per cent diamine brown 3 G.; 2 per cent sal soda; 25 per cent Glauber's.

DARK BROWN.

Three per cent diamineral brown G.; ½ per cent diamine brown M.; 1 per cent diamine catechine B.; 2 per cent sal soda; 30 per cent Glauber's.

NAVY BLUE.

Six per cent diamine dark blue B.; 2 per cent sal soda; 25 per cent Glauber's salt.

WINE.

Five per cent diamine Bordeaux B.; ½ per cent diamine fast red F.; 3 per cent sal soda; 30 per cent Glauber's

PINK.

One-half per cent Erika pink G.; 1 per cent sal soda; 10 per cent salt.

SKY BLUE.

One per cent diamine sky blue FF.; ½ per cent sal soda; 15 per cent Glauber's.

BLACK.

Ten per cent immedial black NN.; 2 per cent soda ash; 10 per cent sodium sulphide; 30 per cent Glauber's.

STOP PEG CHECKS

The above term is used in cotton mills to indicate a type of fabric extensively made for dress goods and decorative purposes. In the dry goods trade the goods are found under various names.

They are an extension of the type of goods, unequally reeded stripes, explained in the last article, and are characterized by certain yarns in both warp and filling, appearing to stand up from the ground cloth in regular or irregular block effects. They are usually woven white and bleached or dyed as may be required.

This article is really supplementary to the last one, the points referred to there applying equally as well here.

A check is almost always formed by a crossover effect in the filling in connection with a distinguishing stripe in the warp. If the effect warp way is not as prominent or more prominent than the effect filling way, a barry pattern is produced, objectionable in almost all classes of textile fabrics.

In stop peg checks the effect warp way is formed by crowding some of the ends and weaving them in a different manner from the others, as in unequally reeded stripes. The effect filling way is formed by interlacing the yarns in a certain manner, say plain for a certain number of picks, then changing the order of interlacing to another weave, say a filling sateen, for a definite number of picks.

When weaving the plain section, the take-up motion of the loom works in the ordinary manner, whereas when weaving the filling satin section it is disconnected, as required, so that more picks will be inserted in a given space.

The device used for disconnecting the take-up motion is usually connected to one of the levers of the dobby and called into action by pegs placed in the pattern chain; hence the term stop peg checks.

A friction let-off is preferrable to a positive lef-off motion for this clas of goods. Fig. 1 illustrates an example of the simpler type, consisting o

sections of plain, warp sateen and filling sateen. The analysis of the sample under consideration shows the following data: Warp, 60s; filling, 90s; cloth width, 27.5 inches. In the plain sections there are, in proportion, 72

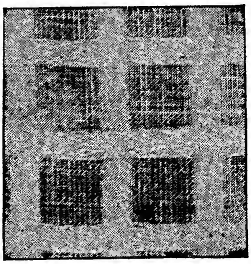


Fig. 1.

ends and 72 picks per inch. The average number of ends and picks per inch is 114 each.

The warp layout for one pattern is as follows:

Ends.	Dents.	
24	12	= 2 ends per dent
30	5	= 6 ends per dent
24	12	= 2 ends per dent
30	5	= 6 ends per dent
108	34	

One warp only has been used.

The harness draft is shown at Fig. 2.

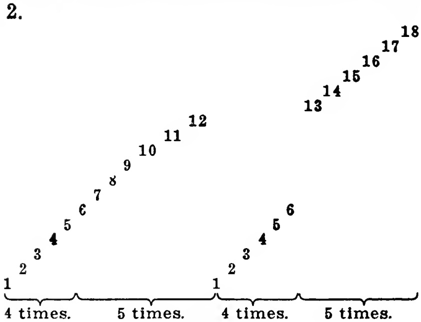


Fig. 2.

The chain draft, exclusive of selvage, is shown in Fig. 3. In this figure marks \ correspond to the plain sections in the cloth; dots correspond to the warp satin sections in the cloth; circles correspond to the filling

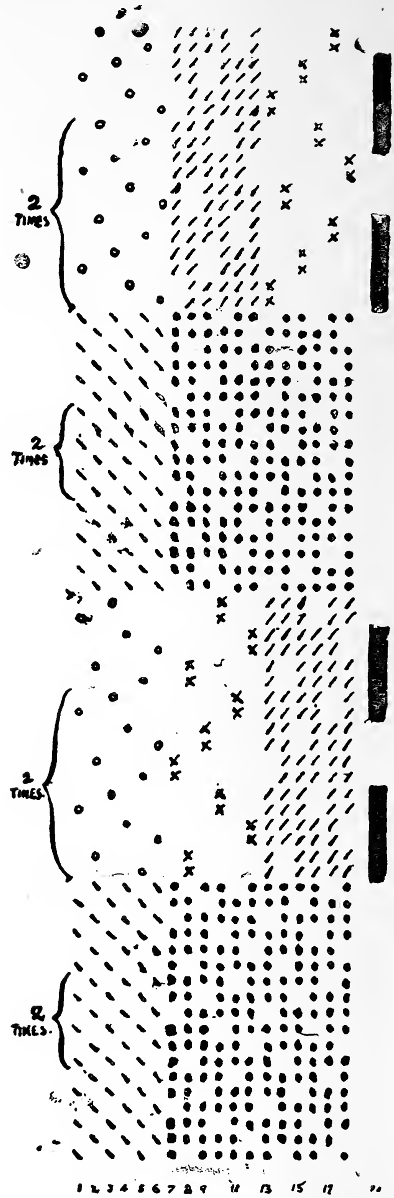


Fig. 3.

satin sections in the cloth; crosses correspond to the filling satin sections in the cloth where the same cross over the ends crowded in the reed, this is a filling satin with two picks in a shed; marks / correspond to the warp satin sections in the cloth where the same cross over the picks forming filling satin with the otherwise plain ends; solid marks indicate stop pegs.

The warp satin sections are woven two picks in a shed when the other sections of ends are weaving filling satin. On these picks the take-up motion is out of connection on 20 out of 30 picks, the entire 30 picks occupying only as much space as 10 picks in the plain sections.

The positions of the stop pegs cannot always be determined before the cloth is being woven. When a change is made from plain to filling satin it is not necessary to insert stop pegs for a few picks because the picks go in easier in the filling satin sections.

LOOM REQUIRED.

An ordinary single box dobby loom fixed with device referred to may be used when weaving these goods. One warp only is required.

Unequally reeded stripes and stop peg checks may be placed in the novelty class, being in demand one season and out of demand the next; also on account of varying considerably in pattern and quality. As such they are usually woven on looms fitted up for weaving from two or more warp beams.

Carding and Spinning Particulars.

The yarns for stop peg checks are made in mills of the second and third divisions as given in a previous article. The counts of yarn used for this fabric differ according to the quality of the fabric desired, and for the carding and spinning particulars we will consider the sample to be made up of 60s warp and 90s filling yarns. Both of these counts of yarn will be combed, the warp yarn being made from 1⅜-inch Allen or peeler cotton and the filling yarn from either Egyptian of 1½-inch staple, or, as is more general, from Sea Island cotton of 1½-inch staple. The processes used for the Sea Island cotton will first be described, and as the processes for 1⅜-inch American cotton have already been described, only those points that differ from those already explained will be given. In mixing Sea Island cotton a great deal of care should be taken to see that all bales put into the mixture staple the same. At the mixing bins the good sliver and picker waste from the machines up to the slubber will be mixed in. As

SEA ISLAND COTTON

has to be handled as little as possible on account of the ease with which neps are put in, generally only one process of picking and an opener is used, although some mills use two processes. If only one process is used the speed of the beater should be just high enough to beat out the dirt, and this varies according to the grade and quality of the raw stock. For a fair average a two-bladed, rigid type of beater should make about 1,200 revolutions per minute, which will give the cotton passing through about 29 beats or blows per inch. The lattice apron of this machine is measured off and marked into yard spaces, and the cotton as it comes from the apron is weighed and spread evenly over this space. The lap at the front end weighs 30 pounds or a 10-ounce lap per yard. A variation of only six ounces either side of standard weight is allowed for this cotton. At the card the same care is taken to prevent neps, and the speed of certain parts is changed to help this result. The speed of the licker-in is reduced about 50 revolutions per minute from that when American cotton is used. The

SPEED OF THE FLATS

is increased to make one complete revolution every 35 minutes; the flats are also set to a No. 10 gauge instead of a No. 12, as compared with American cotton. The cylinder and doffer are only stripped twice a day, but the card wire is always kept sharp and in perfect condition. The weight of the sliver at the front is 45 grains

per yard, and the production for a week of 60 hours should not be over 400 pounds per week. The sliver is next taken to the sliver lap machine or in some cases a drawing frame is used first and a sliver lap machine afterward. If the former method is used, the weight of the lap should be about 230 grains per yard, the doublings being 14 into 1 for an 8¾-inch lap. These laps are doubled at the ribbon lap machine 6 into 1, the weight of the lap at the front being 220 grains per yard. If a drawing frame is used after the card, the ribbon lap machine is not used, and the weight of lap at the sliver lap machine should be 220 grains per yard. The laps at both the ribbon and sliver lap machines should be sized once a day. The laps are next put up at the comber and doubled according to the number of heads it contains, either six or eight. The per cent of waste taken out at this machine for this stock varies according to the overseers' ideas, but a good average per cent is 22.

THE WASTE PERCENTAGE

should be taken from six different combers every day. Keep the rolls well varnished and other parts well polished and as free from dirt as possible. Watch the piecing and also for single. Keep your setting points to gauge and time. The sliver at this machine weighs 35 grains. This sliver is put through two processes of drawing frames, the revolutions per minute of front roll being 320, the doublings 6 into 1 at both processes, and the weight of sliver at the finisher being 60 grains per yard. Follow instructions given for drawing frames in previous articles. The sliver at the drawing frame should be sized 4 times a day, and a variation of only one grain per yard allowed. The drawing sliver is next put up to the slubber and made into .80 hank roving, after which it is put through three processes of fly frames, the hank roving at each being as follows: First intermediate, 2.25 hank; second, 5 hank, and fine, 18 hank. At the fine frames the roving is sized once a day. The usual care that has been previously explained should be given to all parts of the fly frames, and in addition the top leather rolls of the slubber should be varnished. It is best, but not always convenient, to have the slubber rolls used of a little larger diameter than when other cottons are used. This is on account of the length of the staple, to help prevent "licking." The roving is next spun, either a ring frame or mule being used, generally the latter. If a ring frame is used, the gauges should be as follows: For 90s yarn from this stock, 1¼-inch diameter ring, 5-inch traverse, 31 turns per inch and a spindle speed of 7,400. After being conditioned, the yarn is ready to use. For the warp yarn use the particulars given in the article on dhooties, except that the yarn is not twisted. A good size mixture for slasher is as follows; Water, 100 gallons, potato starch, 54 pounds; Yorkshire gum, 2 pounds; white soap, 1½ pounds.

SUSPENDER WEBBING

Suspender webbing is, as the name implies, used for suspenders. It is of two types, elastic and nonelastic. The nonelastic type is made into suspenders in connection with elastic straps connected to the buckles. An advantage claimed for this webbing is that there is no friction on the clothing at the shoulders, the rubber at the front and back, on the part between the buttons and the buckles, taking care of variable tensions caused by the different movements of the body.

Being subjected to hard usage, the goods are made firm in the loom, of strong materials. They are of varying grades and qualities. In width they vary from 1 to 1¾ inches.

The analysis of a cotton webbing of a cheap grade shows the following data: warps, 117 ends of 2-40s cotton for face and edges; 50 ends of 2-20s for back; 24 ends of 2-30s for binders or stitchers; 25 ends of 42 rubber.

There are 90 picks of 2-16s filling per inch, finished. As these goods are held tight in the loom on account of the rubber warp, 60 picks per inch only would be put in the loom, the

webbing contracting 50 per cent in length after being woven.

The width of the web is 1 7-16 inches.

The full layout is shown in the harness draft, Fig. 1, the various warps being drawn as follows: binder ends through harness No. 1, rubber ends through harness No. 2, face and edge ends through harnesses Nos. 3, 4 and 5, and the back ends through harnesses Nos. 6 and 7. The daggers indicate where the ends are divided by the reed, the entire web occupying 27 dents of a reed containing 17 dents per inch.

Each binder end works between two back ends. To add bulk to the fabric, coarse ends are sometimes inserted in the center of the cloth; these are drawn through the same harnesses as the rubber.

The chain draft is shown in Fig. 2. By comparing Figs. 1 and 2 it will be seen that the web is a multiple or compound fabric, all face ends being raised when back picks are inserted, all back ends depressed when face picks are inserted, all rubber ends raised on back picks and depressed on face picks, thereby being between the face and back fabrics.

The binders tie the fabrics into one compound fabric.

LOOM REQUIRED.

Suspender looms are made with more or less attachments according to requirements. They are capable of running upward of 40 webs at the same time, so that production of one loom is considerable. The shuttles, one for each web in the simpler type, are actuated on the rack and pinion principle in a positive manner. On some goods, where silk filling is used for figuring purposes, three or four shuttles are required for each web.

Goods like the one under consideration would be woven on a positively-acted side cam loom, actuated by interchangeable sectional cams. The cams are 12 picks to the round or repeat. One shuttle only is required for each web.

For more elaborate goods a dobby or jacquard head is used in connection with the cams, the latter working the harnesses for the ground, and the head motion actuating the figuring yarns.

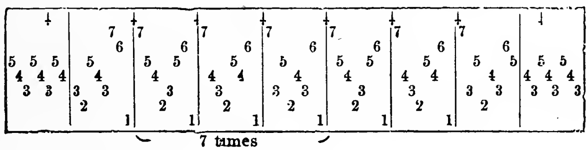


Fig. 1.

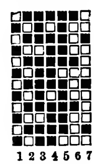


Fig. 2.

Separate warp beams, or spools, are required for each different count of warp yarn, for each web.

Carding and Spinning Particulars.

Like other fabrics that have been already described in these articles, the yarns of which the webbing for suspenders is made vary as to count, but in this special case there is a wide range of the stock used and the question is as to whether it shall be carded, or carded and combed. The higher grades of webbing are composed of the longer stapled cottons, even the longest staple Sea Island being used for the very fine grades, this cotton being, of course, combed, and from this down to the short stapled carded cotton. The sample that has been taken for this article is of medium grade and is composed of four different counts of yarn, which are as follows: 2-40s warp for face

and ends and 2-20s for the back; 2-30s is used for the binder and 2-16s for the filling yarns. The 2-40s and 2-30s yarns would be constructed from the same staple and stock or American cotton of 1 5-16-inch staple, and the 2-20s and 2-16s would be made from peeler cotton of 1⅛-inch staple. The picking particulars that have been given in previous articles may be used for these counts and staple cottons may be used, the following exceptions being noted. The total weight of the lap at the different processes for the 1 5-16-inch stock is as follows: breaker picker, 40 pounds or a 16-ounce lap; intermediate picker, 38 pounds or a 12-ounce lap and at the finisher picker 35 pounds or a 12½-ounce lap. For the 1⅛-inch stock the weights would be as follows: 40 pounds or a 16-ounce lap at the breaker, 39 pounds or a 12½-ounce lap at the intermediate and 39 pounds or a 14½-ounce lap at the finisher picker. The beater speeds used would be the same for both cottons, i. e., 1,500 revolutions per minute at breaker and intermediate and 1,450 revolutions per minute at the finisher, which gives the cotton passing through the finisher picker about 42 beats or blows per inch. At the card the draft of the 1 5-16 inch stock should be not less than 100 and the speed of the licker-in 350 revolutions per minute, while the flats, 110, make one complete revolution every 50 minutes. The

WEIGHT OF THE SLIVER

should be about 60 grains per yard and the production 750 pounds per week of 60 hours. The draft for the 1⅛-inch stock should not exceed 95 and the speed of the licker-in is about 375 revolutions per minute, while the flats make a revolution every 55 minutes. The weight of the sliver should be 65 grains per yard and the production 850 to 900 pounds per week. For all other particulars see previous articles. The main point of difference in the setting points would be at the licker-in and feed plates, which should be set to accommodate each staple. The slivers are next put through three processes of drawings, the doublings at each process being 6 into 1.

The weight of the sliver at the finisher drawing should be 70 grains per yard for both staples and the speed of the front roll 350 revolutions per minute. Either metallic or leather-covered top rolls may be used, but should favor the metallic rolls for these stocks. The drawings should be sized four times a day, and kept within two grains either side of standard weight. Watch your stop-motions and also the drawing as it is being delivered, to see that no cut work is made, for this causes a lot of trouble in subsequent processes. All drawing as it is delivered in full cans at the finisher drawing should be marked with chalk so that it may always be distinguished from the other staples, kinds and weights. These slivers are then put through the slubber and made into .50 hank roving, after which they are made into the following hank roving at the different processes named: For the 2-40s yarn, first intermediate, 2 hank, and second, 8 hank; for 2-30s yarn, first intermediate, 2 hank, and second, 6 hank; for 2-20s yarn, first intermediate, 1.25 hank, and second, 4 hank; for 2-16s yarn, first intermediate, 1, and 3 at the second intermediate. These rovings ohould be sized once a day, six bobbins being sized from each different hank.

WATCH YOUR TWIST

to see that you are putting in neither too much nor too little, and also your tension to see that you are not putting too great a strain on the yarn and thus making strained or unevenly drawn roving. The layers per inch are also another important point, and for the hank rovings given above a good number is as follows: For the 3 hank, 20 layers per inch; for 4 hank, 25 layers; 6 hank, 33 layers, and for 8 hanks, 38 layers. The top leather rolls should always be kept in good condition and if not should be sent to be recovered. In putting in new rolls always put two new rolls on the same arbor and not, as is sometimes done, one old roll and one new roll. Keep rolls well oiled and also the spindle stops, which should be oiled at least once a month.

The roving is next spun on spinning frames into 40s, 30s, 20s and 16s, respectively. The particulars for these frames, with the exception of the 16s, have been previously given. For spinning 16s filling use a frame having a 2¾-inch gauge, 1½-inch diameter ring and a 6½-inch traverse with a spindle speed of 7,000 revolutions per minute of the spindles. The yarn is then put through several special processes different from the machinery used for regular cloth warp and filling, when it is ready for the suspender loom.

Dyeing Particulars.

SKY BLUE.

One per cent diamine sky blue FF.; 2 per cent sal soda; 20 per cent Glauber's.

PINK.

One-half per cent Erika pink G.; 1 per cent sal soda; 10 per cent Glauber's.

LIGHT GREEN.

One-half per cent diamine fast yellow B.; ½ per cent diamine green G.; 1 per cent sal soda; 10 per cent Glauber's.

YELLOW.

One per cent chrysophenine; 2 per cent sal soda; 20 per cent Glauber's.

RED.

Two per cent diamine fast red F.; 1 per cent sal soda; 20 per cent Glauber's.

SCARLET.

Three per cent benzo fast red 4 B.; 2 per cent sal soda; 20 per cent Glauber's salt.

SLATE.

One per cent diamine black BH.; ¼ per cent diamine fast yellow A.; 1 per cent sal soda; 20 per cent Glauber's salt.

BROWN.

Two per cent diamine brown B.; ½ per cent diamine fast yellow A.; 2 per cent sal soda; 20 per cent Glauber's salt.

NAVY BLUE.

Three per cent diamine dark blue B.; 1 per cent sal soda; 20 per cent Glauber's.

BLACK.

Five per cent oxydiamine black NA.; 2 per cent sal soda; 20 per cent Glauber's; after-treat with formaldehyde.

BRONZE.

Three per cent diamine bronze G.; 2 per cent sal soda; 20 per cent Glauber's.

ECRU.

Two ounces diamine catechine G.; ½ pound sal soda; 10 per cent Glauber's.

INDIAN DIMITY

Under the head of dimity are a variety of cotton fabrics characterized by stripes and cords, in both warp and filling way of the fabric, but more commonly the stripes and cords are in the warp only.

Dimity originally was understood to mean a stout cotton fabric with raised stripes, cords, crimps or ridges in the warp way of the fabric. These fabrics were further ornamented by being printed in various colors lengthwise of the fabric, in small patterns. This fabric was principally used for furniture covering and for like purposes.

Under the head of Indian dimity is a class of fabrics somewhat similar to the dimity described above, but made with finer yarn and used principally as a dress fabric.

The stripes and cords, however, constitute

THE CHARACTERISTIC FEATURE

of the fabric; the fabric without these stripes and cords would in all respects resemble a fair quality of lawn, batiste or muslin.

The cords in an Indian dimity appear in the fabric at regular intervals across the entire width. These cords may be effected by working two or more ends on the same harness or by using a coarser thread than the body of the warp. The cord usually interlaces with the filling in the same manner as the ground; that is, on the plain weave order. In addition to these cords, the fabric, after it is woven, is printed in stripes in the direction of

the warp, with high colors. The patterns of these stripes are usually conventionalized floral figures. These floral stripes may alternate with an appropriate geometrical figured stripe. In the latter stripe the colors are usually more subdued, thus producing contrast and variety, a very desirable feature in a dress fabric, especially so in the cheaper grades of printed dress fabrics.

Varying the quality of cotton fabrics is such a general practice and is carried to such an extent that some fabrics lose their individuality; a fabric such as an Indian dimity, that has features in addition to its construction, has considerable scope for variation, consequently we find various grades and styles of Indian dimity—some in which the cords are much farther apart than in others, or sufficiently spaced to allow the stripe to be printed between the raised cords, and others in which the cords are very close together, with but two or three ends between each cord. (See weave Fig. 1.) In printed fabrics of this character where the printed patterns are in the form of a stripe, the cords should not be too prominent, or, if they must be prominent, the printed stripe should be of such a design that the outline is of an indefinite character, so that if any inaccuracy occurs in

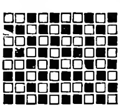


Fig. 1.

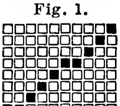


Fig. 2.

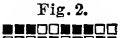


Fig. 3.

the printing, that is, if the cloth does not run perfectly straight through the printing machine, and the printed stripe interlaces too much with the cord, it appears as if the printed stripe was promiscuously placed on the fabric. The neatest patterns are those in which the ends are not very prominent and the stripe is printed over them at apparently regular intervals. Fig. 2 represents the drawing-in draft; Fig. 3 the reeding plan.

ANALYSIS OF FABRIC.

Width of warp in reed, 30½ inches; width of fabric finished, 29 inches; ends per inch finished, 94; 1,300 x 2 reed; ends in warp, 2,724.

Dressing: 1-2 E. white in 1 hed.
1 E. white.
1 E. white.
1 E. white.
4-5

Take-up of warp during weaving, 8 per cent; warp yarn, 1-80; filling yarn, 1-100. Picks per inch, 76.

LOOM REQUIRED.

Light-weight cotton fabrics, such as an Indian dimity, may be woven on any light built single box loom. The principal consideration should be given to the speed of the loom, as fabrics of this class require large production in order to amply compensate the manufacturers for making them. High-speed looms would answer for weaving this class of goods.

FINISHING.

The fabric, after it is woven, is bleached, then slightly stiffened by immersing in a light solution of size. The size may be composed of the following ingredients: flour, wax and gelatine. After the sizing the fabric is dried, then slightly sprinkled with water, then run through a rotary press, after which follows the printing process. The fabric is then again slightly pressed in order to take out the creases which it contracted during the printing; then it is made up into laps or rolls.

Carding and Spinning Particulars.

The yarns that make up Indian dimity are made in mills of the third division, as given in a previous article. The fabric is generally made from peeler or Sea Island cotton of from 1 7-16 to 1½ inch staple. The sample under description is composed of 1-100s filling yarn and 1-80s warp yarn and for this article we will consider both yarns to be made from 1½-

inch staple, Florida Sea Island cotton. Particular care should be paid to the mixing of this cotton and all bales not up to grade and staple should not be used. At the mixing bin the good sliver from the machines up to the slubber should be mixed with the raw stock. Too much waste should not be mixed on account of making the lap fleece. As this cotton is of a long staple it is very easy to put neps into it, and thus too great a speed of the beater of the picker should not be allowed. The beater should be run just fast enough to take out the dirt. This speed varies, on different stocks of the same length of staple, from 800 to 1,350 revolutions per minute. A good average speed of a two-bladed, rigid type of beater for the breaker is 1,200 revolutions per minute, and for the finisher, 1,025 revolutions per minute. This latter speed gives the cotton passing through it about 29 beats or blows per inch. Sea Island cotton is generally put through only two processes of pickers and sometimes does not even pass through an opener, although this is an exception rather than a rule. At the breaker picker the lap at the front end weighs 30 pounds or a 12-ounce lap. These are put up and doubled 4 into 1 at the finisher picker, and the total weight of lap at this machine is 29½ pounds, or a 10-ounce lap. A variation of one-half pound either side of standard weight is allowed. These laps are put up at the card. The

DRAFT OF THIS MACHINE

for this stock varies according to the idea of the one in charge, but should not be less than 125. The top flats should be clothed with No. 36s wire and should make one complete revolution every 35 minutes. The speed of the licker-in should be less than that used for shorter and coarser cottons and should not exceed 300 revolutions per minute, as it is claimed that this speed is high enough to tear it apart and clean it thoroughly and still not put neps into it. The doffer should be of as large a diameter as possible and should be clothed with No. 36s wire fillet. The cylinder fillet should be No. 34s. The weight of the sliver should be about 37 grains and the production, per week of 60 hours, 350 pounds. Clean, strip, and grind cards, as has been already stated in previous articles. The sliver is then taken to the sliver lap machine and for an 8¾-inch lap is doubled 14 into 1. The weight of the sliver at the front of this machine is 230 grains per yard of lap.

Watch your stop-motions on this machine. The laps are put up at the ribbon lap machine and doubled 6 into 1, although some mills make a heavier lap at the sliver lap machine, and only double 5 into 1 at the ribbon lap machine. The weight per yard of lap at the front of this machine is 210 grains. The rolls of the sliver lap machine for this stock are set as follows: Front to middle, 1⅝ inches; middle to back, 1⅞ inches and for the ribbon lap, front to second, 1⅝ inches; second to third, 1¾ inches; third to back, 1⅞ inches. The laps are put up at the comber and doubled either 6 or 8 into 1, according to the number of heads that the comber contains, which we will consider to be 6. The sliver from this machine weighs 35 grains per yard; 25 per cent waste is taken out and the speed of the machine is 90 nips per minute. Use setting and timing previously given for this grade of stock. The cotton is next put through two processes of

DRAWING FRAMES,

the speed of the front roll being 350 revolutions per minute, and the weight of the sliver at the finisher drawing being 60 grains per yard. It is an important point to prevent all singles and doubles at this machine and to help make perfect drawing all stop-motions should be in perfect condition. Another important part to watch is the setting of the rolls. For this stock a good rule is as follows: Front to second, 1⅝ inches; second to third, 1¾ inches; third to back, 1⅞ inches. These settings may be used at both drawings, although if settings are closed up 1-16 of an inch between each roll at the finisher drawing it will not injure the staple.

The top leather rolls of the sliver lap, ribbon lap, comber, and drawing frames should be kept in perfect condition and always well varnished. A stock of new and newly varnished rolls should always be kept on hand and the rolls on the machine examined frequently to see that they are perfect. Good recipes for varnish have been previously given. Parts of the machines to which it is not a general custom to give much notice are the clearers. Now they are important and should be looked after carefully to see that they are doing their duty properly. This refers to both top and bottom clearers on all machines on which they are used.

At the slubber the drawing is made into .80 hank roving. At this machine watch the top rolls, the build of the bobbin, the lay, twist, tension and traverse motion. For this stock the front rolls are generally varnished and if it is in a mill made to run this length of stock the top and bottom front rolls are of a larger diameter so that the stock will not lick up so easily. The roller settings for the slubber are as follows: front to middle, 1⅜ inches; middle to back, 1¾ inches.

THE SLUBBER ROVING

is then put through three more processes of fly frames, the hank roving made at each process being as follows: First intermediate, 2.25; second, 5, and fine, 18 hank for warp yarn and 20 hank for filling yarn. The warp yarn is ring spun on a frame having a 1⅜-inch diameter ring, 5¼-inch traverse, 39.08 twist per inch and a spindle speed of 9,600 revolutions per minute. The yarn is then spooled and warped and then run through a slasher, after which it is drawn in and is then ready to weave. A good slasher size for this yarn is as follows: Water, 100 gallons; potato starch, 70 pounds; tallow, 7 pounds; Yorkshire gum, 3 pounds; white soap, 2 pounds. Boil two hours and let stand 10 hours before using. Keep agitator running and keep size almost at a boiling point when sizing. The yarn for filling is generally mule spun, after which it is conditioned and then is ready for weaving.

Colors for Printing.

PALE VIOLET.

Prepare ten gallons of printing paste with one pound chrome violet M for printing; 60 pounds gum solution 1. 1; two pounds glycerine; 33½ pounds water. Heat to about 160 degrees F., allow to cool, then add 2½ pounds formic acid, 90 per cent; 1 pound acetate chrome, 32 degrees Tw.

DEEP VIOLET.

For 10 gallons paste, 10 pounds chrome violet M for printing; 50 pounds starch tragacanth 65 : 1,000; 34 pounds water. Heat to about 160 degrees F., allow to cool; add 2½ pounds formic acid, 90 per cent; 3½ pounds acetate of chrome, 32 degrees Tw.

BLUE.

For 10 gallons paste, 14½ pounds chrome fast blue F R for printing; 3½ pounds chrome violet M for printing; 45 pounds starch tragacanth thickening; 12 pounds water; heat to about 160 degrees F.; allow to cool then add three pounds hyraldite A, dissolved in 3½ pounds water; one pound formaldehyde, 40 per cent; 2½ pounds formic acid; 15 pounds acetate of chrome; steam through Mather & Platt. The pieces are then left exposed to the air for several hours, passed through a weak chrome bath, washed, soaped, rinsed and dried.

SKY BLUE.

Two and one-half ounces alizarine blue S P; 2½ pints gum thickening; 1 quart water; ½ pint acetate chrome 32 degrees Tw. Print and steam and soap.

PEA GREEN.

Two pints alizarine green D G paste; 1½ gallons tragacanth thickening; 1 gill acetate of chrome 32 degrees Tw.; 2 quarts water. Print, steam and soap.

PINK.

Four ounces rhodamine 6 G; ½ pint water; 1½ quarts tragacanth thickening; ¼ pint acetic acid, 9 de-

grees Tw.; ¼ pint acetate chrome, 32 degrees Tw. Print, steam and soap

RED.

One pound brilliant Rhoduline red B D; 1 gill glycerine; 2 pints water; 1½ pounds acetic acid, 9 degrees Tw.; 1 gallon gum water, 1 : 1; 2 pints acetic acid, tannic acid solution, 1 : 1. Print, steam one hour, soap.

PURPLE.

Five ounces methyl violet 2 R; 2½ quarts water; 3 pints acetic acid, 9 degrees Tw.; 1¼ gallons gum water 1 : 1; 1½ pints acetic acid, tannic acid solution 1 : 1. Print, steam one hour, soap.

GRENADINE

Grenadine is a fine gauzy dress fabric made with various combinations of materials, such as silk and cotton, silk and wool, or cotton and wool, and some of the cheaper grades are made with all cotton yarns.

The fabric is plain and loosely woven and invariably ornamented by stripes, sometimes in both warp and filling, but usually in the warp only. These stripes may be of an ordinary satin or uneven sided twill weave. In the better grades of grenadine the ornamentation is more intricate, that is, the figuring is of such a character that it requires a special loom, such as a lappet or swivel loom. If the figuring is to be effected by means of an extra filling, the swivel loom is used. With the use of this loom the figuring is in the form of spots or set figures over the entire fabric.

The grenadine of which the analysis will follow, is a cotton warp and silk filling fabric, ornamented with a zigzag warp stripe, effected by the lappet attachment to the loom.

This method of forming stripes on a fabric was in use prior to the introduction of the swivel loom. The method of operation in this class of weaving consists of passing an independent set of threads through a series of needles set in a frame. This frame is situated between the reed and shuttle race way of the lay.

This frame is arranged so as to slide horizontally to and fro. This sliding is regulated by the pattern chain, and the needles are lowered at the proper time, so as to allow the figuring threads to interlace with the ground cloth, by passing the filling over the figuring threads, thereby binding the figuring threads into the ground structure of the fabric. The movements of the needles may be timed so as to interweave with the ground cloth at each throw of the shuttle or otherwise, as may be desired. The figuring threads, however, must be on a separate warp beam on account of the difference of take-up during weaving.

Diagram, Fig. 1, illustrates the method of interlacing the figuring threads into the ground structure of the fabric.

This fabric, as mentioned above, is of an openwork texture. The construction, that is, the ends and picks per inch in the ground structure of the fabric, should be of such a number as to make the fabric firm enough to fulfill its purposes. As the fabric is used entirely for dress goods, it is subjected to considerable wear. In order to retain its characteristic feature, that is, transparency or openness of texture, the ends and picks per inch should be of such a number that in the finished fabric the meshes will be no larger than the diameter of the yarn used in the fabric; otherwise the fabric will not wear satisfactorily.

From the above it will be observed that in order to produce a fabric that is satisfactory in all its aspects, viz., appearance, feel or handle and wearing qualities, absolute accuracy is required in calculating for the construction of such a fabric. Grenadine may be woven in the gray, then dyed any color desired, or the warp may be dyed in the hank and the filling dyed after it is woven into the fabric. In the better grades these fabrics are usually woven with dyed yarns. The prevailing color for grenadines is solid black.

ANALYSIS.

Width of warp in reed, 30 inches; width of fabric finished, 27.5 inches;

ends per inch in reed, 84; ends per inch finished, 92. Reed, 42x2; take-up of ground warp during weaving, 5 per cent; take-up of figuring warp during weaving, 12 times the length of fabric woven; ground warp, 1-60s cotton; figuring warp, 2-40s mercerized cotton.

In the drawing in, the ground warp only is drawn through the heddles in the harness; the figuring warp passes over the harness into the eyes of the needles, the needles being in front of the reed. The figuring warp is not drawn through the reed, but is guided entirely by the needles.

Filling: 1¼ dram silk, picks, 90 per inch finished.

Fig. 2 shows ground and figure weave.

Fig. 3 ground warp drawing-in draft.

LOOMS USED.

These fabrics are woven on various looms, various makes of dobby looms, lappet, swivel or jacquard, depending entirely on the character of figure to be woven. The jacquard loom is used when the fabric is to be ornamented by large broken plaids, requiring too many ends to be conveniently handled on a dobby loom.

FINISHING.

The finer grade of grenadine requires very little attention as regards finishing. After the fabric comes from the loom it is examined for broken threads or picks. The finishing is practically in the weaving. If the fabric is perfect when it comes from the loom, it is run through the rotary press, subjected to a little steaming and slight pressure, and then made up into laps ready for the consumer.

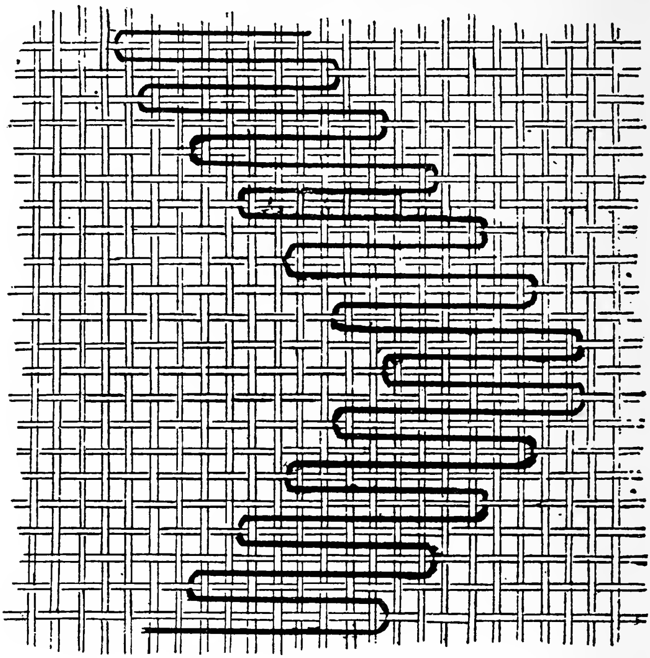


Fig. 1.

Carding and Spinning Particulars.

The counts of yarn used for the warp in the sample described above for grenadine are 1-60s ground warp

and 2-40s for figuring warp. The staple cotton used for the ground warp would be about 1⅜-inch for Allen or peeler cotton, while that used for the figuring warp, which is mercerized, would be made from an Egyptian or Sea Island cotton, which is especially adapted for mercerizing purposes, of 1⅜-inch staple. The 1⅜-inch peeler cotton would be er, 40 pounds or a 16-ounce lap, intermediate, 38 pounds or a 12-ounce lap, and at the finisher, a 38-pound or a 13-ounce lap. For the Sea Island stock there would be an opener and two processes of pickers, the speed of a rigid, two-bladed beater being as follows: 1,300 revolutions per minute at breaker and 1,200 revolutions per minute at finisher; the weight of the lap

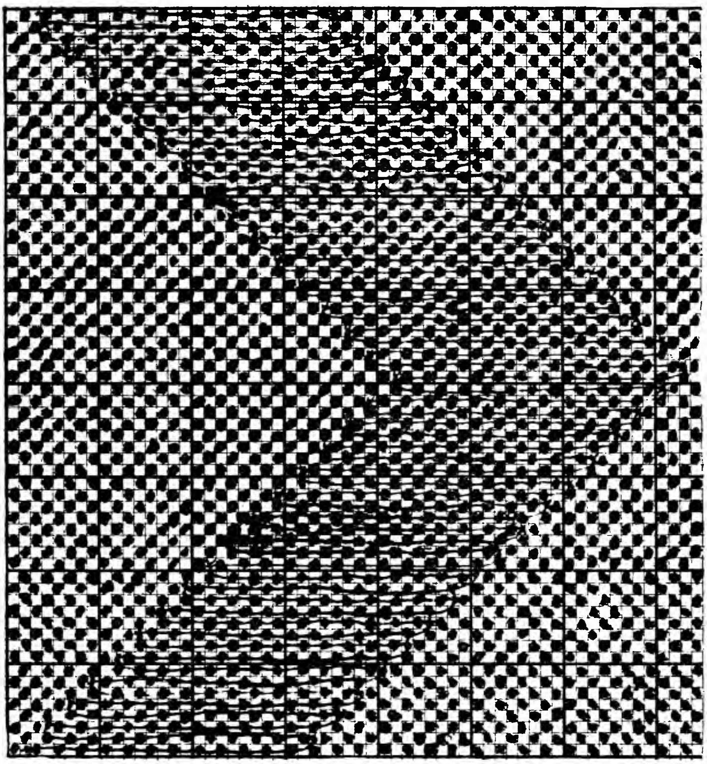


Fig. 2.

put through an opener and three processes of pickers, the speed of a two-bladed beater being as follows: Breaker, 1,500 revolutions per minute; intermediate, 1,400 revolutions per minute, and finisher, 1,400 revolutions per minute. The weights of the lap for this fabric would be, at the breaker, 40 pounds or a 16-ounce lap, intermediate, 38 pounds or a 12-ounce lap, and at the finisher, a 38-pound or a 13-ounce lap. For the Sea Island stock there would be an opener and two processes of pickers, the speed of a rigid, two-bladed beater being as follows: 1,300 revolutions per minute at breaker and 1,200 revolutions per minute at finisher; the weight of the lap would be 34 pounds or a 10-ounce lap at breaker, and at the finisher 30 pounds or a 10½-ounce lap. For general instructions for mixing and picking, use those that have been previously given. At the card the particulars used for the peeler cotton are: A draft of not less than 110, with a

licker-in speed of 300 revolutions per minute, flats (110) making one complete revolution every 35 minutes. The speed of the cylinder is 160 revolutions per minute. The production should be 500 pounds with a 45-grain sliver for 60 hours per week.

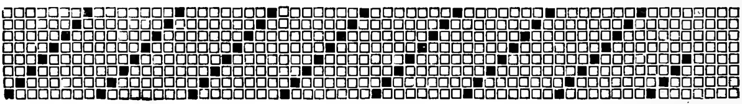


Fig. 3.

FOR SEA ISLAND STOCK

the draft should not be less than 130. The speed of the licker-in is 275 revolutions per minute, flat 1 revolution in 35 minutes, the weight of sliver 40 grains per yard and the production 350 pounds per week. The wire fillet used for both stocks should be 34s for cylinder and 36s for top flats and doffer. Use as large a doffer as possible. The setting points have been given previously for these stocks. Strip three times a day and grind each card at least a day every month. Both the Sea Island and the peeler cottons for this class of goods are combed and for this article we will suppose that an 8¾-inch lap is used. For

THE PEELER STOCK

the ends are doubled 14 into 1 at the sliver lap machine or, as it is sometimes called, the small doubler, the weight per yard of the lap being 300 grains, and at the ribbon lap or large doubler these laps are doubled 6 into 1, the weight of the lap being 280 grains per yard. These laps are put up at the comber and doubled 6 into 1. The percentage of waste taken out is 16 and the weight of the sliver is 45 grains per yard. Use settings and timings previously given. For the Sea Island stock the weight at the sliver lap is 220 grains per yard and these laps are doubled 6 into 1 at the ribbon lap machine, the weight of the lap being 215 grains per yard. At the comber the doublings are 6 into 1 and the weight of sliver is 35 grains per yard; 20 per cent of waste is taken out and the settings and timings used are the same as those given in the article on Indian dimity.

VARNISH.

Do not use the same varnish for the sliver lap, ribbon lap and draw box rolls and the leather detaching rolls of the comber. For the latter use a varnish that has less glue and a dead finish, while for the former rolls use a roll with a smooth, glossy finish, but use a varnish that does not peal or crack easily. Always keep rolls well varnished and in good condition. The comber sliver is next put through two processes of drawing frames, the doublings being 8 into 1 at the breaker for peeler and 6 into 1 for Sea Island, while at the breaker the doubling is 6 into 1 for both stocks.

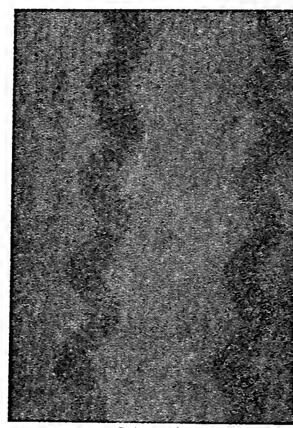


Fig. 4.

If metallic rolls are used they should be spread ⅛ of an inch farther apart than when leather top rolls are used. Watch the stop-motions. The weight of the drawing sliver at the finisher drawing is 75 grains per yard for the peeler and 60 grains for the Sea Island stock.

At the slubber the sliver for 60s yarn is made up into .50 hank roving, after which it passes through three processes of fly frames or speeders, being made into the following hank roving at each process: 1st intermediate, 1 hank; 2d intermediate, 3 hank, and fine frame, 12 hank. The Sea Island stock is made into .70 hank at the slubber and passes through two processes of fly frames, where it is made into 2.25 hank roving at 1st intermediate and 8 hank at finisher frame. Use all the precautions given in previous lessons as to rolls, etc., and remember that the Sea Island stock

REQUIRES LESS TWIST

per inch than the peeler. The peeler cotton is made into 60s hank on a warp spinning frame, the particulars of which have been given in a previous article, while the Sea Island is made into 40s yarn on a warp frame having a 1½-inch diameter ring with a 6-inch traverse and a spindle speed of 10,000 revolutions per minute; this is then twisted and put through the mercerizing process, after which it is ready for use.

A good slasher sizing for 60s yarn for light-weight cloth is as follows: Water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds, and white soap, 1½ pounds.

Dyeing Particulars.

Dyed in jig machine.

BLACK.

8 per cent thion black TGC.; 8 per cent sulphide sodium; 3 per cent soda ash; 20 per cent salt.

BLUE.

6 per cent thion blue B.; 10 per cent sulphide sodium; 3 per cent soda ash; 20 per cent salt.

Dye and rinse well. After-treat with 2 per cent peroxide sodium; 8 per cent sulphate magnesia; 8 per cent acetic acid, 8 degrees Be. Dissolve the sulphate of magnesia first, then put in the peroxide of sodium in small quantities, and enter the goods; work for 20 minutes first; then run the acetic acid into the bath, and gradually increase the heat to about 180 degrees F.

BROWN.

4 per cent thion brown R.; 4 per cent thion brown O.; 2 per cent thion orange N.; 12 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

BRILLIANTE

Brilliante is a cotton fabric of light or medium weight, distinguished by small, detached figures, usually of geometrical or simple character, arranged on a plain ground. The figures are formed with the filling, which is soft twisted.

The object sought is to cover the warp with the filling as much as possible, both in the ground and figure. It is obtained by using warp yarns considerably finer than those used for the filling in the same piece, aided by the slack twist in the filling.

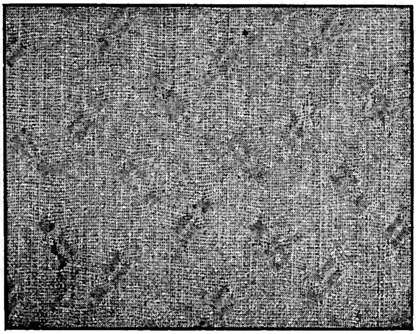


Fig. 1.

The goods are used principally for shirtwaists and dress goods.

Fig. 1 illustrates a typical brilliante fabric, the analysis of which shows the following data: 88 sley, 66 picks, 50s warp, 30s filling; finished width, 26¾ inches. The pattern is complete on 100 ends and 84 picks. The figures are arranged in irregular positions, 8 in a repeat.

One of the figures is illustrated in Fig. 2; marks represent filling.

Like many other cotton fabrics, goods under this name are made in various grades, variations in the counts of yarns necessitating corresponding variations in the counts of cloth. A

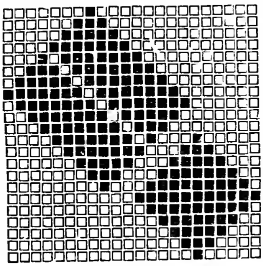


Fig. 2.

fabric under consideration, shown in Fig. 3, has a filling so coarse, as compared with the warp, that it has the appearance of a poplin ground. This is a dobby pattern, the spots being arranged in a 4-end sateen or broken crow order. Each spot is made by the filling covering nine ends on two picks, as in Fig. 4. The float of the second pick of each alternate spot is moved over two ends.

LOOM REQUIRED.

Most brilliante patterns necessitate the use of a jacquard head. A machine of 300 or 400 hooks gives ample scope for designs. The goods being of firm

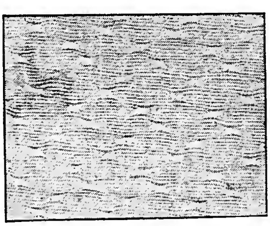


Fig. 3.

structure, with all the ends taking up practically evenly, they could be woven most economically on a light running single box loom fitted with a double lift, single cylinder jacquard. One warp and one filling only are required.

There being but little scope for developing other than small designs of this type, on dobby looms, they are made to but little extent on these looms. Experience has taught that patterns like Fig. 3 require too many harnesses on a dobby loom for weaving plain to the best advantage.

FINISHING.

These goods are usually subjected to the English or French nainsook finishes, mercerized or printed. By the English finish the fabric, after it leaves the loom, is boiled off, then bleached, after which it is softened by immersing in a light solution of glycerine, or cocoanut oil, and flour or farina, after which it is dried by passing over heated cylinders, then run through a rotary press with very light pressure. In the French finish, after the fabric is bleached it is stiffened by immersing in a solution of size, composed of the following ingredients: flour, wax and gelatine, after which the fabric is dried, then slightly sprinkled with water, then run through the calender, which completes the finishing process.

The fabric illustrated in Fig. 1 has undergone the mercerizing process of finishing, having been mercerized in the piece. Brilliante is a type of goods in which the essential qualities of the pattern are improved by the mercerizing process.

When they are printed, the printed patterns are secondary to the weave effects and usually consist of small detached sprig or floral effects arranged a great distance apart.

Carding and Spinning Particulars.

The yarns of which brilliante is composed are made in mills of the second and third division, as given in a previous lesson. The yarns used in the sample under consideration are 50s for warp and 30s for filling. Both of these yarns are combed and made from the same grade and staple of cotton. The filling is coarser, and, according to established rules, should be made of a

shorter length of staple, and this would be true if it were not for the fact that in order to produce certain effects in the cloth this yarn is required to have a softer twist than that generally employed for this count of yarn. The cotton used may be a peeler of 1¼-inch staple.

THE MIXING

would be done as described in previous articles, the good sliver waste from the machines up to the slubber being thrown into the mixing bin. If the equipment of machinery does not include a roving waste machine, a good way to mix the roving waste is as follows: Run the roving waste through a picker, allowing it to run on the floor at the front, and not formed into a lap as is generally done; this is then gathered up and scattered over the mixing. This is a very good method, but is not generally used on account of the pickers having all they can do to keep up with the cards. This class of work is put through an opener and three processes of pickers. The pickers, if supplied with a rigid type of beater having two blades, have the following

SPEEDS

at each process: Breaker picker, 1,500 revolutions per minute; the fan speed 1,400 revolutions per minute; intermediate picker, 1,450 revolutions per minute; fan speed, 1,050 revolutions

Fig. 4.

per minute; finisher picker, 1,450 revolutions per minute; fan speed, 1,100 revolutions per minute. The weights of the lap at the different processes are as follows, the doubling at each process after the breaker picker being 4 into 1: breaker picker, total weight, 40 pounds; weight per yard, 16 ounces; intermediate picker, 39 pounds or a 12-ounce lap, and finisher picker, 36 pounds or a 12½-ounce lap. Of course the laps should be kept of as even a weight as possible, a variation of only 8 ounces either side of the standard weight being allowed at the finisher picker. These laps are put up at the card, and for this fabric the draft shoud not be less than 110. The licker-in speed should be 300 revolutions per minute. Flats should make one complete revolution every 38 or 40 minutes. The weight per yard of the sliver at front is 50 grains per yard and production for a week of 60 hours is 550 pounds. Set doffer to cylinder to a 5-1,000th-inch gauge; licker-in to cylinder to a 7-1,000th-inch gauge. Set cylinder screen at licker-in to 12 gauge, at center to a 34 gauge, and at front, ¼ inch.

Set back plate to cylinder at 10 gauge at bottom and at 22 at top; licker-in screen to licker-in, 3-16ths inch from licker-in. Set licker-in knives top knife at 12 gauge, bottom knife at 5 gauge; if only one knife, set at 5 gauge. Set feed plate to cylinder according to length of staple. This is

AN IMPORTANT POINT

many times overlooked by men in charge. The general rule is to set at this point the same for all lengths of staple. This is wrong, because in short-staple cotton the feed plate should be set closer than for long stock. For example, suppose the feed plate is set to licker-in at 7 gauge for 1⅛-inch stock and we will say that this gives the distance from bite of feed roll to licker-in 1¼ inches. Now we change to 1¾-inch Sea Island stock. If we do not reset the feed plate we are almost sure to break the fibre, and if the cotton is stapled at the front of the card and compared with the staple at the back, it will be seen that this is what is being done. Of course the proper remedy for this is to get a feed plate with the proper shaped nose for each length of staple, but it is not always possible to do so; the

NEXT BEST REMEDY

is to set the feed plate farther back or to slow down the speed of your licker-in, so that the fibres will not be struck away from the feed roll so quickly. If the setting at this point is the same for all staples and gives a variation of ½-inch length in staple at front and back, note result. If the staple breaks,

it is weakened so much. Set top flats to 12 gauge at back and to 10 gauge at other setting points. Set front stripping plate to 22 gauge at bottom and at top set from a 7 to a 12 gauge, according to the strip wanted.

At the sliver lap machine the doublings are 14 into 1 for an 8¾-inch lap, the weight of a yard of lap being 295 grains. These are doubled 6 into 1 at ribbon lap, the weight being 275 grains per yard. At the comber these laps are doubled either six or eight into one according to the number of heads. For a 6-head comber the sliver at coiler should weigh 45 grains per yard; speed of comber, 90 nips per minute; percentage of waste, 15; and draft about 27.50. Use same setting and timing as given in previous articles. At

THE DRAWING FRAME

two processes are used, the doublings being 6 into 1 at each process. The speed of front roll at each process should be 400 revolutions per minute, and the weight of the sliver at the finisher drawing should be 70 grains per yard. At the slubber this is made into .60 hank roving and is put through two processes of fly frames, the hank roving at each process for the 50s warp being 2.50 at first intermediate, and 10 hank at second process. For the 30s the hank roving at the first intermediate is 2 and at the second process 6 hank. Look out for the points that have been explained in previous articles. At the spinning room the roving for warp yarn is spun into 50s under the following conditions: diameter of ring, 1½ inches; length of traverse, 6 inches; twist per inch, 31.80; spindle speed, 10,000 revolutions per minute. The filling yarn is mule spun, with 2.75 times the square root of count for standard twist.

Dyeing Particulars.

NAVY BLUE.

Four per cent naphtamine blue 2 B.; 25 per cent Glauber's; 3 per cent sal soda.

PINK.

One-half per cent Erika pink G.; 20 per cent Glauber's; 1 per cent sal soda.

SKY BLUE.

One-half per cent diamine sky blue F F.; 10 per cent Glauber's; 1 per cent sal soda.

PEA GREEN.

One per cent diamine sky blue; ½ per cent chrysophenine; 20 per cent Glauber's; 1 per cent sal soda.

ECRU.

One-half ounce naphtamine brown N.; 1½ ounces naphtamine yellow N N.; 10 pounds salt; 1 per cent sal soda.

YELLOW.

One per cent direct yellow G conc.; 20 per cent salt; 1 per cent sal soda.

RED.

Three and one-half per cent direct scarlet B conc.; 25 per cent salt; 2 per cent sal soda.

BROWN.

Four per cent naphtamine brown R G.; 30 per cent salt; 2 per cent sal soda.

GREEN.

Four per cent diamine green G.; ½ per cent diamine fast yellow B.; 25 per cent salt; 3 per cent sal soda.

BOOK MUSLIN

Book muslin is a textile term that is somewhat of a misnomer, not having any connection with fabrics used for book coverings. The goods are used very extensively for stiffening and lining clothing and for the foundation work of ladies' hats; they are distinguished more by the feel or finish than by appearance. They vary in appearance from plain weave to small checks. Being made more for utility than effect, fancy weaves are not called for or necessary. One of the principal weaves used is a leno, one end crossing one.

An analysis of a book muslin sample shows the following data: Finished width, 32 inches; 24s yarn in both

warp and filling, 54 ends and 45 picks per inch.

The weave is shown in Fig. 1, being on 16 ends and 8 picks. The general effect is shown by 8 ends and 8 picks, the next 8 ends differing only in the plain weave being reversed. Fig. 2

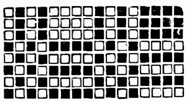


Fig. 1.

1 2 1 2 1 1 1 1 2 1 2 1 2 2 2 2

Fig. 2.

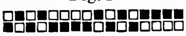


Fig. 3.

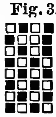


Fig. 4

shows the harness draft and Fig. 3, the reed draft. The warp yarns average 8 ends in 5 dents, there being 16 ends in 10 dents per pattern. The 4 ends working as 1 are drawn through one heddle. The chain draft is shown at Fig. 4, the working of the first two, or selvage, harnesses being plain.

Stop pegs are not required, the 3 picks in 1 shed coming into contact with each other.

Another book muslin fabric under consideration contains the same counts of yarns as the other sample. The count of this cloth is 43x38, and the width 35 inches finished. The weave is plain.

Book muslins are usually woven grey and piece dyed in solid colors.

LOOM REQUIRED.

Any of the three classes of weaves mentioned may be woven on single box, fast, light running looms. The sample analyzed would require a dobby loom. The leno and plain weave samples could be woven best on cam looms. One beam only is required.

FINISHING.

Before finishing, the goods feel very sleazy. The effect obtained by finshing is to change this cloth into a very stiff, board-like fabric. Goods for linings are sized the least; those for stiffening and millinery purposes are sized heavily.

After being woven, the cloth is washed, dyed, dried, sized, dried and folded as desired. No burling, singeing or shearing is required, as perfect cloth is not absolutely essential and the glue or size, combined with the pressing, lays the loose fibres.

In sizing, the cloth passes through the size box and on to the drying cylinders. If a glazed finish is required, it is subjected to pressure by the heated rollers of the calender machine.

The sizing substances are usually glue, gum, flour and size, of variable proportions, mixed with water to the desired consistency. The weight of size in a piece will vary from about 5 to 40 per cent of the entire weight.

Carding and Spinning Particulars.

The yarns that make up book muslin are made in mills of the first and second divisions. For this class of fabric a short-staple medium grade of cotton is used. The general staple is about one inch. In the better qualities of this fabric only the raw stock is used in the mixture, but the poorer qualities contain a certain percentage of waste, either comber or card being used according to the quality required. For this article we will consider that the mixture is made up without waste.

THE MIXING

for this class of cotton should be as large as possible because production is looked to more than quality, but the quality should be as good as possible. The cotton is put through an opener and three processes of pickers. The speed of the beater of the opener should be 1,050 revolutions per minute, the fan on this machine making 350 revolutions per minute. This opener is generally directly connected to the breaker picker. This picker may be provided with either a pin, or, as it is sometimes called, a carding beater, or a rigid type having either two or three blades. If a two-bladed, rigid beater, the speed should be 1,500 revolutions

per minute; if a three-bladed beater, the speed should be reduced to 1,000 revolutions per minute. The fan speed should be 1,400 revolutions per minute. The draft of this picker should be about 1.85. The

WEIGHT OF THE LAP

at the front should be, total, 40 pounds; weight per yard, 16 ounces. These laps are put up and doubled 4 into 1 at the intermediate picker. The beater of this picker, if a two-bladed, rigid type, makes 1,450 revolutions per minute with a fan speed of 1,050 revolutions per minute and a draft of 2.80. The total weight of lap at the front is 38 pounds or a 10-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. The speed of this beater, if two-bladed, should be 1,450 revolutions per minute; fan speed, 1,100 revolutions per minute; draft, 2.80; weight of laps at front, 39 pounds or a 14½-ounce lap. The stock passing through this machine with these speeds receives about 41 blows or beats per inch. At the card the speed of the licker-in varies from 300 to 350 revolutions per minute, according to make of card. The speed of flats is 1 revolution every 45 minutes (110 flats).

THE CARDS

should be stripped at least three times a day and the doffer should be stripped an extra time if a very large production is being turned off. Use a coarse wire fillet for both doffer and cylinder for cards on this stock, and use settings given for indigo prints in a previous article. The draft of the card should not exceed 100 for this class of goods. The weight of the sliver should be 65 grains per yard and the production 850 pounds for a week of 60 hours. Grind cards as previously stated. The card sliver is next put through two processes of drawing, the doublings being 6 into 1 at each process. The speed of the front roll is 400 revolutions per minute for leather top rolls and 375 for metallic top rolls. Metallic top rolls will be found to be an advantage on this class of stock, but should be looked after to see that they are properly set. Generally speaking, metallic rolls should be set 3-16ths of an inch farther apart than leather top covered rolls. If metallic rolls are used, care should be taken to see that they are the same distance apart their entire length, because if they have sprung, cut work will be the result. The flutes of these rolls should be kept clean and the bearings well oiled and clean or bad results will be obtained. The weight of the sliver at the front of both breaker and finisher drawings should be 72 grains per yard. Drawings should be sized four times a day. The drawing should be put up to the slubber and made into .50 hank roving and put through two processes of

FLY FRAMES.

At the first intermediate it is made into 2 hank roving and at the second 5 hank. Of course these hank rovings will depend a great deal on the way a room is balanced and the amount of production to be turned off. Sometimes two different stocks of the same length of staple will be run together at the slubber and first intermediate frames that are going to be made into two different counts of yarn. This is often done in rooms where there are not enough frames to have each frame run a different stock, so that it may be necessary to alter the draft and hank roving of one or both stocks to the best advantage of each. Thus it will be seen that the hanks and drafts given here may be used as a foundation from which to work, and used if each machine is using this one staple, and grade and kind of cotton. The roving is taken to the spinning frame and made into 24s yarn. At the warp frame use a 2-inch diameter ring, 7-inch traverse, 23.27 twist per inch and 9,400 revolutions per minute spindle speed. For a filling frame use 1½-inch diameter ring, 6½-inch traverse, 15.9 twist per inch and a spindle speed of 7,600 revolutions per minute. A heavy sizing is used for this class of goods.

Dyeing Particulars.

Dyed on the jig machine.

BLACK.

Five per cent oxydiamine black A T.; 3 per cent sal soda; 20 per cent salt.

BROWN.

Five per cent diamine brown B.; 1 per cent diamine fast yellow B.; 2 per cent sal soda; 25 per cent salt.

SLATE.

One and one-half per cent diamine black B H.; 2 ounces diamine fast yellow B.; 2 per cent sal soda; 25 per cent salt; make up a starch liquor with 10 ounces dextrine; 1 gallon water; mix cold. Add a little color to match shade required, and boil well for one hour. Starch on mangle and dry on the tenter frame.

MULL

Mull may be defined as a thin, plain woven fabric, of which there are several varieties, as Swiss, India, starched, China or silk. The China or silk mull is a union fabric, usually with cotton warp and silk filling. This is the finest fabric of the above-mentioned varieties and is used exclusively for dress goods.

The Swiss and India mulls are fine soft-bleached cotton fabrics, principally used for dress goods.

THE STARCHED MULL

is somewhat coarser than the Swiss or India mull and is used principal-

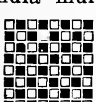


Fig. 1.
Design.

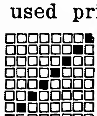


Fig. 2.
Draft.

ly for stiffening in various parts of a dress, usually dresses of unwashable material, and is also used as a foundation for ladies' silk trimmed hats, curtains, etc. Starched mull is a plain, loosely woven fabric and is stiffened in the finishing process by sizing.

These various qualities of mull differ in point of texture considerably from one another; the silk mull is in point of texture twice as fine as some grades of cotton mull.

The China or silk mull and also the cotton mull used for dress purposes are characterized by their softness. This feature is partially brought about by the materials used and partially by the finish which the fabric receives. The silk mull requires less attention in finishing, as the materials used in the construction of the fabric, the silk filling in particular and the high grade of the cotton warp, are in themselves conducive to producing a soft fabric.

In the cheaper grades of cotton mull, wherein the coarser counts of yarn are used, the warp yarn must first be well sized so as to withstand the tension and strain incurred during the process of weaving. This sizing, while it strengthens the warp yarn, imparts to the fabric a harsh handle or feel, due to the ingredients used in the size, which may be wheat, flour, farina or sago and a small quantity of softening materials, usually tallow or wax. The softening materials are necessary in order to make the yarn pliable; otherwise it would be inclined to be too brittle to weave readily. After the fabric is woven and ready for the finisher, it is subjected to a

WASHING PROCESS,

which takes out all the sizing materials in the warp yarn, after which the fabric is subjected to a combination of sizing materials for the sole purpose of softening the fabric. The above process applies more particularly to the all-cotton fabrics.

This class of fabrics—mull—requires very little ingenuity on the part of the designer to produce, there being no ornamental features or fancy weaves. The goods are plain woven, depending for their beauty or attractiveness entirely on the finishing. Mull made for dress goods is of fine texture, and is finished very soft, while the fabric intended for lining or decorative purposes is much coarser in texture than the dress fabric, and is stiffened in the finishing and commonly known as starched mull.

The goods are usually woven in the gray and the bulk of them are finished pure white or bleached, although these fabrics may be obtained in almost any color desired.

The China or silk mull is usually, like the all-cotton fabric, finished undyed. In the former case, however, the cotton yarn is bleached in the hank. The silk filling used in this fabric is raw silk, viz., tram silk. This is soft and very pliable and lends itself readily to the production of a soft fabric. The filaments of raw silk cannot be spun into a thread like wool and cotton, as they have no peculiarities of surface that correspond to the scales on the surface of the wool fibres; the wool fibres, when spun into a thread, are arranged so that these scales are opposed to one another as much as possible and thereby interlock and hold fast to one another, and the more the threads are spun, the closer they engage one another and in consequence produce a stronger thread. The peculiarities of the cotton fibre are its twists. The cotton fibre under the microscope appears as a thin flat tube or ribbon, considerably twsted; these twists in the fibres give strength to the thread by interlacing with one another somewhat on the order of the scales in the woolen threads. In silk, however, the filaments can only be made into a thread by twisting a number of the filaments into fine threads, and these threads are again twisted until a thread of the desired count is obtained. Following is an

ANALYSIS

of a cotton and silk fabric:

Width of warp in reed, 28½ inches; width of fabric finished, 27 inches; ends per inch in reed, 76; ends per inch finished, 80; ends in warp, including selvages, 2,200; reed, 1,400x2; warp yarn, 1-60s cotton.

Filling, one dram silk, tram; 54 picks.

ANALYSIS OF STARCHED MULL.

Width of warp in reed, 33¼ inches; width of fabric finished, 30 inches; ends per inch in reed, 36; ends per inch finished, 40; ends in warp including selvage, 1,220; reed, 1,300x1; warp 1-50s cotton.

Filling, 1-54s cotton; 36 picks.

LOOM REQUIRED.

Any ordinary single box loom may be used for weaving this fabric. The speed of the loom is the most important consideration if the selection of loom be optional; the finer grades of mull are usually woven on eight harnesses, straight draft, while the coarser grades are confined to four harnesses, drawn in the following order: 1, 3, 2, 4.

FINISHING.

Mull made for dress goods is of a very fine texture and softened in the finishing. This is accomplished by immersing the fabric in a solution of oily matters, the ingredients being composed of a liberal percentage of glycerine or cocoanut oil and a very small quantity of farina. Chloride of magnesium may be used with good results. This is a very powerful softener, as well as a weighting material, and has a great affinity for water, and has the power of attracting moisture to the cloth in which it is used. This attraction of moisture really constitutes the softening effect. The above method of softening applies in particular to all-cotton mull. In the silk filling goods the fabric is usually only boiled off, then run through a rotary press.

For stiffening the fabric, the goods, after they are bleached, are immersed in a solution of size composed of flour, tallow, and gum arabic; this stiffening is done in front of the drying cylinders, the goods running through the sizing trough on to the cylinders, which completes the finishing.

Bleaching Particulars.

Boil with 4 degrees Tw. caustic soda in a kier for 12 hours, and run through washing machine.

Give a second boil with 4 degrees Tw. caustic soda.

Wash through machine and run through solution of chloride of lime at

½ degree Tw. Place in bin for two hours. Pass through a solution of sulphuric acid ½ degree Tw. Pass through washing machine till all trace of acid is eliminated.

Starching Particulars.

One gallon: 4 ounces dextrine, 4 ounces cornstarch. Boil for one hour and starch through mangle.

Dry on the tenter frame.

LINON

Linon, usually termed India linon or India linen, is a fine, closely woven plain fabric well known for its excellent wearing and washing qualities. It is made from combed cotton yarns of long-staple stock.

It is made in various widths, from 27 to 36 inches, and in slightly varying constructions and qualities. The goods are made to resemble as closely as possible fine linen fabrics. The cloth structure is firmly made in the loom.

The analysis of a good quality India linon fabric shows the following data: Ends per inch, 108; picks per inch, 110; finished width, 36 inches; warp, 90s; filling, 110s. Each selvage consists of 16 ends of 2-90s.

The yarns were reeded 2 ends per dent in the loom. The selvages were also reeded 2 ends per dent, i. e., 2-ply yarns. Two of these would be equal to 4 of the single yarns.

Woven with about 94 ends per inch in the loom, it will be seen that a very fine reed has been used. This was necessary in order that an even surface, practically free from reed marks, should result.

LOOM REQUIRED.

The goods may be woven on a single box plain loom of not too light construction. On account of the fairly large number of picks per inch and the fine quality of cloth, a firm, steady take-up motion on the loom is necessary.

The ends are drawn in in the regular 1, 3, 2, 4 skip shaft order, on twine harnesses. One warp beam only is required. Practically all fabrics usually woven on cam looms may also be woven on dobby looms, if necessary.

To weave the fabric under consideration, on a dobby loom, the ends should be drawn in straight on at least 8 harnesses to prevent overcrowding of the heddles.

FINISHING.

A good finish for these goods is to singe, wash, bleach, size or starch with a light Indian corn or potato starch, the former material being preferable; then calender, dry and make up as required. A second dampening and calendering, following the first calendering, improves the quality of the finish. Very little stiffening or starch is used because the goods are intended to be washed frequently. When finished, the goods have the appearance of a smooth linen finished lawn. They are slightly glossy.

Carding and Spinning Particulars.

The division of mills that make the yarns that India linon is composed of is the third. This division of mills, as given in a previous article, is the one that makes the finest yarns and is equipped with machinery suitable to do this. India linon is made from a good quality of Sea Island cotton of about 1½ to 1⅝ inch staple. For this class of goods it is quality and not quantity that is the main consideration. The cotton is mixed as has been described in previous articles, the good sliver being mixed in at this point, as well as laps that are too light and cut sliver waste, if any is made at any of the processes. Some overseers put cut sliver through the last process again, and let it go at that, but the only proper method to remedy this kind of work is to put it back into the mixing.

FOR THIS FABRIC

the cotton is put through two processes of pickers, and an opener. The opener should be kept as full as possible so that as even a feed as possible will be obtained. The breaker picker is generally equipped with a two-

bladed, rigid type of beater, the speed of which is 1,200 revolutions per minute. Some overseers prefer a pin beater, but others claim that it puts neps into long-staple cotton. This is undoubtedly due to improper setting as well as not running it at the proper speed. The weight of the lap at the front of this picker is 32 pounds or a 9¾-ounce lap. These laps are doubled 4 into 1 at the finisher picker. This picker has a two-bladed beater, whose speed is 1,050 revolutions per minute, or about 29 beats per minute. The speed of this beater should be just high enough to get the dirt out of the cotton and not injure it. The total weight of the lap at the front of the picker is 30 pounds or a 9½-ounce lap. A variation of 6 ounces either side of standard is allowed; if laps weigh outside of this they are either put through the finisher picker again or if a great deal too light or too heavy they are put back into the mixing again. These laps are put up at the card. The cards used for this stock should be kept free of all dirt, etc., and the card fillet should be kept sharp and parts properly set to each other. The flats should make

ONE COMPLETE REVOLUTION

every 35 minutes, the licker-in speed should not exceed 280 revolutions per minute, and the weight of the sliver at the front should be 40 grains per yard. It is an important point that the cards should be kept extra clean. The production of a card for a week of 60 hours should not exceed 275 pounds. The draft should be not less than 130. After passing through the cards, the sliver is generally put through sliver lap, ribbon lap and comber processes. At the sliver lap the doublings for an 8¾-inch lap are 14 into 1. The weight of a yard of lap at the front of this machine is 220 grains. These laps are put up at the ribbon lap machine and doubled 6 into 1. The weight of a yard of sliver at the front of this machine is 210 grains. These are put up at the comber and doubled 6 into 1 if a six-head comber, or 2 into 1, if comber is an eight-head comber. Set and time the comber for this stock the same as given in a previous article on Sea Island cotton. Keep all parts of comber that the cotton comes in contact with well polished and free from dirt. If more than one end breaks on the table the sliver at the front should be broken before entering the coiler and the broken ends pieced up before the sliver is allowed to enter can. If any single has entered the can, it should of course be removed and the end properly pieced again; be sure and make a good piecing, not one that will break back at the succeeding process or one that will not draw out. The sliver is then put through three processes of drawing, the doublings of which are all 6 into 1. The weight of the drawing at the front of the finisher drawing should be 65 grains per yard. For

THIS CLASS OF WORK

leather top rolls are generally used. These should be kept well oiled and varnished and in perfect order. The drawings should be sized four times a day and the ribbon lap at least once a day. Look out to see that your stop-motions are all in perfect order and working. Be sure that there are no laps on the third bottom steel roll or in fact on any roll, as this will tend to produce cut sliver as well as throw the size out. Keep drawing on heavy size of standard weight. This sliver is next put up at the slubber and drawn into .80 hank roving. The bottom steel rolls should be a little larger in diameter than when used for shorter staple. This is in order to prevent licking. The clearers on the slubber should be picked frequently and not allowed to collect until they drop down and pass into the work. The hank roving at the fly frame is as follows: for filling first intermediate, 2.25 hank; second intermediate, 5 hank; fine, 20 hank; for warp yarn, first intermediate, 2.25 hank; second, 5 hank, and fine, 18 hank; for the selvage yarn use the same hank roving as for the warp yarn. On this grade of stock the slubber rolls should be varnished and some overseers varnish the front rolls of their first intermediate frame. The leather top rolls should be in per-

fect condition and special care should be given to the rail or carriage and the parts that operate it to see that they change sharply and that there is no dwell at the top and bottom of the bobbin, for this may cause it to run over or under and make a bad bobbin, or if this does not happen, it will break back at the spinning frame or mule every time it gets to the top or bottom of the bobbin, thus causing a lot of trouble, besides the liability of singles, which should be looked out for at all processes. Full bobbins should never be thrown into the boxes, but should be packed. The roving for filling may be taken to either the mule or spinning room; if the latter, use a frame having a 5-inch traverse, 1¼-inch diameter ring and a spindle speed of 7,400 revolutions per minute. This yarn is then conditioned, then it is ready to use. The warp yarn is frame spun on a frame having a 2¾-inch diameter ring; 5-inch traverse, and a spindle speed of 9,400 revolutions per minute. This yarn is put through the spooler and warping processes and from here to the slasher, where sufficient beams are put up at the back to give the required number of ends at the front. For this class of goods the following size mixture may be used: Water, 100 gallons; potato starch, 70 pounds; tallow, 7 pounds; Yorkshire gum, 3 pounds; white soap, 2 pounds; boil two hours and let stand ten hours. Before using, keep agitator running, and keep size at almost boiling point.

Dyeing Particulars.

PINK.

Two ounces diamine fast scarlet 4 B.; ½ pound sal soda; 20 per cent Glauber's salt.

PEARL.

Two ounces thion violet black A.; 3 ounces thion black T B C.; 1 per cent sulphide sodium; 1 per cent soda ash; 20 per cent salt.

NAVY BLUE.

Ten per cent immedial indone B B.; 10 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

LIGHT BLUE.

Five per cent immedial sky blue F.; 5 per cent sulphide soda; 1 per cent soda ash; 20 per cent salt.

ECRU.

Four ounces thion brown G.; 1 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

SAGE GREEN.

One per cent thion green G.; ½ per cent thion yellow G.; 1½ per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BROWN.

Eight per cent thion brown G.; 2 per cent thion brown O.; 10 per cent sulphide sodium; 2 per cent soda ash; 30 per cent Glauber's.

MYRTLE GREEN.

Two per cent thion yellow G.; 6 per cent thion green G.; 8 per cent sulphide sodium; 2 per cent soda ash; 30 per cent Glauber's salt.

SLATE.

Four ounces thion black T R.; ½ per cent sulphide sodium; 1 per cent soda ash; 15 per cent Glauber's salt.

TAFFETA SILK LINING OR TAFFETINE

This is a fabric made with a silk warp, cotton, linen or wild silk filling. Taffetine is a term variously used at different times; specifically it is a fine, glossy, closely woven, uncorded and untwilled fabric, used entirely for ladies' wear in the form of a lining, underskirts, etc. Taffetine derives its name from the more costly fabric taffeta. This fabric is of

QUITE ANCIENT ORIGIN,

being in use as early as the 16th century as a dress fabric for both men and women. Taffeta of the 16th century was a thick, costly fabric, made with silk and wool. In the 17th century the fabric was defined as a soft, thin fabric. In the transition the goods have undergone a complete change of texture and in the 18th cen-

tury taffeta was a very lustrous silk fabric, sometimes checked or flowered or striped with gold and silver.

The taffetine under consideration is a fine, plain-woven fabric with warp threads per inch greatly in excess of filling threads per inch and the warp of a much finer count than the filling.

THE FINEST QUALITIES

of fabrics are made on this basis. The warp yarn for these goods is invariably raw silk, technically known as organzine or thrown silk, and the filling may be cotton, linen or artificial silk.

The raw silk used for filling in silk fabrics is technically known as tram silk. This is similar to the organzine; the difference lies in the twisting of the filaments. These filaments are put together very loosely with

LITTLE OR NO TWIST;

consequently, they are not as strong as the more firmly twisted fibres, but sufficiently strong to answer as filling.

When the filaments cannot be drawn from the cocoon in one continuous thread, due generally to the cocoon being damaged by the worm in eating its way out, these cocoons are torn up and the filaments are combed and laid parallel to one another, and the thread made from the damaged cocoons is known as spun silk.

The spun silk is not as smooth or as fine as the raw silk thread, although some of the fibres are of considerable length and strong enough to be used for warp threads. Spun silk is calculated by the weight on same basis as cotton, namely, 840 yards to 1 hank, or, 840 yards of No. 1s equal one pound. Raw silk is calculated as to the size of thread, on the hanks in drams avoirdupois; thus, if one hank weighs 1 dram, it is known as 1 dram silk, or 256,000 yards equal 1 pound.

During recent years there has been a tendency among manufacturers using silk to designate the size by the denier method. Raw silk generally is designated by this method when it is first purchased in the skein form and in order to avoid confusion many are using the same method when the silk has been thrown or spun. In this method the basis is the weight of 450 meters (about 500 yards) when weighed by a unit of 5 centigrams (about 7¾ grains). This gives a yardage per pound for a number 1 denier of 4,464,538. In order to find the denier size, if the yards per pound are known, it is only necessary to divide the standard number of yards by the yards per pound in the size considered. If the denier size be known it is only necessary to divide the size into the standard number of yards to obtain the yardage per pound. Of course, there is a certain amount of allowance usually made in the yardage because of silk variation or for the take-up in the throwing process, etc, but the foregoing is the basis upon which estimates are made. Cotton manufacturers more than woolen manufacturers are becoming accustomed to raw silk sizing upon the basis mentioned. Woolen manufacturers are more accustomed to use the dram silk sizing.

THE FILLING

for these fabrics is either cotton, linen or wild silk. Linen filling is used in the best grades of taffetine; linen yarn is prepared similarly to worsted thread, notwithstanding that linen is a vegetable fibre. The raw flax is first beaten or crushed in order to make it pliable; then it is combed, or passes through the process technically known as scutching. Flax fibres must be of a certain length in order to work properly. If too long, they are broken in a machine called a saw.

After the fibres are combed they are carded and the long fibres are spun into linen yarn, while the short fibres are converted into what is known as tow yarn. Taffetine is sold in both narrow and wide widths. The narrow fabric is usually about 19 inches wide. This narrow fabric is commonly

WOVEN DOUBLE WIDTH,

then cut in two after the fabric is woven.

In order that the ends may not fray out after the fabric is cut, the goods are made with a fast center selvage, In warping, extra ends are allowed

just as in an ordinary outside selvage. In the center of the warp, these ends are reeded double, as is the common practice for reeding selvages, leaving one or more dents empty where the fabric is to be cut.

Fast center selvages are extensively used in the manufacture of ribbons, scarfs, cheaper grades of cassimeres and, in fact, any fabric characterized by its narrowness.

The fast center selvage consists of crossing one thread over two or more threads, similarly to the douping of threads in leno weaving.

See diagram, Fig. 1.

The douping or crossing of threads is effected by an attachment on the back of the loom, directly in the center of the loom if but two pieces are to be woven; the threads that are crossed rest stationary in the attachment, while the crossing threads cross over from one side to the other at each pick or every two picks as may be desired. The crossing thread and the threads over which it crosses must be reeded in the same dent, as in leno weaving.

ANALYSIS.

Width of warp in reed, 40 inches, double width; width of fabric finished, 19 inches, single width; ends per inch finished, 106; ends per inch in reed, 100.

Reed, 50x2; ends in warp, double width, 3,920; outside selvages, 80; center selvages, 80; equals total of 4,080 ends in warp.

Take-up during weaving, 10 per cent; warp, 1¼ dram organzine silk. Filling, 1-50s combed and gassed cotton; 88 picks per inch.

LOOM REQUIRED.

Plain woven silk warp fabrics may be woven on any light, smooth-running loom. The essential consideration is the heddles. For this class of fabrics the French string heddles are considered the best, as they are less liable to break or chafe the warp during the process of weaving in comparison with the ordinary wire heddle.

FINISHING.

The goods require little in the way of finishing. After the fabric is dyed it is slightly stiffened by immersing in a light solution of size. The stiffening and the materials used in the construction of the fabric produce a crisp and rustling effect.

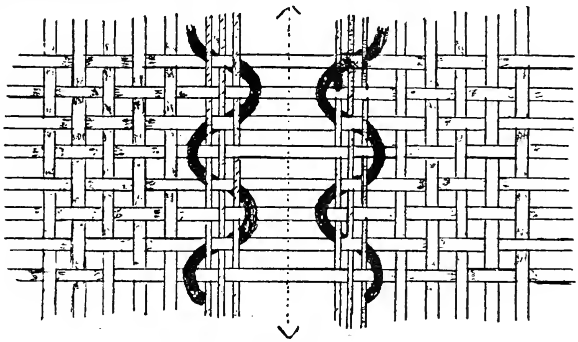


Fig. 1.
Dotted line indicates where fabric is to be cut.

Carding and Spinning Particulars.

Taffetine is composed of yarns made in the second division of mills as given in a previous article. These mills are equipped with combers. The warp yarn of the fabric under description is silk and the filling yarn is cotton. For this class of fabric two kinds of raw stock may be used, either a medium staple Sea Island cotton, or an Egyptian cotton. We will assume that an Egyptian cotton of good grade and

of 1⅜-inch staple is used. As Egyptian cotton is

MORE EASILY WORKED

than American cotton, the speeds at which the different machines are run are higher, as will be noted by comparing this article with some of the other articles in which an American cotton of the same grade and length of staple has been described. Egyptian bales of cotton are baled better and compressed more tightly than American bales, the average weight being 800 pounds, instead of 500 pounds, as compared with the American bales. The cotton should be allowed to stand in the bins a little longer than the American bales, so as to allow the cotton to expand. The good waste from the machines up to the slubber is put into the mixing. The cotton is then passed through either two or three processes of

PICKING

and an opener. Keep the opener well filled with raw stock so that as even a feed as possible may be obtained. The speed of the beater at the breaker picker is 1,500 revolutions per minute and the total weight of the lap at the front is 40 pounds or a 20-ounce lap. These laps are doubled 4 into 1 at the intermediate picker. The speed of this beater is 1,450 revolutions per minute. The total weight of the lap at the front is 37½ pounds or a 12-ounce lap. The doublings at the finisher picker are 4 into 1, the speed of the picker being 1,450 revolutions per minute. The total weight of a lap at the front of the picker is 35 pounds or a 12½-ounce lap. These laps are put up at the card. The licker-in speed is 350 revolutions per minute. The flats make one complete revolution every 30 minutes, and the cylinder 160 revolutions per minute. The draft of the card for this class of goods is 135. The sliver at the front weighs 45 grains per yard and the production for a week of 60 hours is 550 pounds. Use the same

SETTINGS AT THE CARD

as have been previously given for 1⅜-inch staple American cotton. The grinding and stripping times are also the same. The sliver is next put through a sliver lap machine, when it is doubled 14 into 1 for an 8¾-inch lap. The draft of this machine is about 2. The bottom steel rolls are spread as follows for this staple of cotton: Front to middle, 1⅝ inches; middle to back, 1⅞ inches. The weight of a yard of lap at the front is 295 grains. These laps are doubled 6 into 1 at the

RIBBON LAP MACHINE.

The bottom steel rolls of this machine are spread as follows: Front to second, 1½ inches; second to third, 1⅝ inches; third to back, 1¾ inches. The weight of a yard of lap at the front of this machine is 275 grains. A size of the lap at this machine should be taken once a day. A variation of 2 grains either side of the standard is allowed before changing the draft gear. These laps are put up at the comber and doubled according to the number of heads that the comber contains—generally 6 or 8. If a six-head comber is used, six laps would be put up at the back. The percentage of waste taken out for this stock is 18. The settings of the draw box rolls are: Front to middle, 1 7-16 inches; middle to back, 1½ inches. The speed of the comber is 90 nips per minute. The timings and settings are the same as given in a previous article. The percentages of the combers should be taken regularly, the general method being to take so many combers a day. Keep needles in good condition and straight and free from waste. See that the half-lap needles are in good condition, and that the timings and settings are as they should be. About two combers a week should be scoured by a comber man and his helper. The weight of a yard of sliver at the coiler of this machine is 40 grains. This sliver is next put through two processes of

DRAWING FRAMES,

the doubling being either 6 ends up at both processes or, as is often done, 8 ends up at the breaker and 6 ends at the finisher. The weight per yard of the sliver at the finisher drawing is 74 grains. The top rolls used may

be either metallic or leather. The settings of the rolls are as follows: Front to second, 1½ inches; second to third, 1⅝ inches and third to back, 1¾ inches. This setting is for leather rolls. If metallic rolls are used, set ⅛ of an inch wider. Size at the drawing frame four times a day. At the slubber the sliver is drawn into .50 hank roving, after which it is put through three processes of fly frames, the hank roving at each process being as follows: First intermediate, 1.25; second intermediate, 3; and fine frame, 10 hank. This cotton requires 1 tooth more twist than American cotton for the same hank roving. Set the jack frame bottom steel rolls as follows: Front to middle, 1 7-16 inches, and middle to back, 1½ inches. Size 10 hank roving once a day. Watch the usual points at the speeders that have been already pointed out in previous articles.

THE FILLING

is either mule or frame spun, generally mules being used for this class of goods. If frame spun, the requirements of a frame are as follows: Gauge of frame, 2¾ inches; diameter of ring, 1¼ inches; length of traverse, 5½ inches; speed of spindles, 8,200 revolutions per minute. The yarn is then run over or through a gas flame to take off all fuzz and give it a luster.

Dyeing Particulars.

The dyeing of goods composed of silk and cotton is generally done in open vats provided with a winch, in some cases also on a jigger if the material to be dyed requires it. Colors which dye silk and cotton are used, dyeing first with the substantive color, with soap and phosphate of soda, or common salt and a little sal soda. Should the silk require colors to be made a little brighter, acid colors are used in a bath of soap and acetic acid, or a basic color is dyed in a soap bath with acetic acid, the color dyeing both the cotton and silk a brighter shade. For pale shades: 10 gallons liquor; 5 ounces soap; ½ ounce sal soda; 3 ounces phosphate soda. For heavy shades: 10 gallons liquor; 6 ounces soap; ½ ounce sal soda; 6 ounces phosphate soda; 10 ounces Glauber's salt. The temperature of the dye-bath is generally about 195 degrees F. After dyeing, the pieces must be well rinsed, and raised with acetic acid, in cold water: 10 gallons water; 1½ pints acetic acid.

BLACK.

Eight per cent union black S.; 1 per cent diamine fast yellow A.; 30 per cent Glauber's; 2 per cent sal soda; 2 per cent soap. Top with alizarine black 4 B.

SEA GREEN.

One-half per cent diamine black H W.; 4 ounces diamine fast yellow B.; topped with new methylene blue N.; new phosphine G.

For 10 gallons dye-liquor: 6 ounces soap; ½ ounce sal soda; 3 ounces phosphate soda.

NAVY BLUE.

Three per cent diamine dark blue B.; 1 per cent diamine brilliant blue G.; topped with new methylene blue N X.; metaphenylene blue B.; indigo blue N.

PEARL.

Two ounces diamine gray G.; 1-16 ounce diamine brown M.; topped with aniline gray B.

SLATE.

Ten ounces diamine gray G.; ⅛ ounce diamine brown M.; topped with cyanol extra, orange extra.

LIGHT MAUVE.

One ounce diamine violet N.; ½ ounce diamine brilliant blue G.; topped with methyl violet B 1.

VIOLET.

One per cent diamine violet N.; ½ per cent diamine brilliant blue G.; topped with methyl violet B 1.

PINK.

Two per cent diamine rose B D.; topped with rhodamine G.

RED.

Three per cent diamine fast red F.; topped with safranine S 150; acid violet 4 R S.

SKY BLUE.

Four ounces diamine sky blue F F.; topped with cyanol extra.

LIGHT BROWN.

One per cent diamine brown B.; ½ per cent diamine yellow B.; topped with Bismarck brown F F.; thioflavine T.

MYRTLE GREEN.

Two per cent diamine black H W.; 2 per cent diamine green B.; 1 per cent diamine fast yellow B.; topped with brilliant green; new methylene blue N.

SCARLET.

Three per cent diamine fast scarlet G B.; ½ per cent diamine orange D C.; topped with safranine G G S.; tannine orange R.

CREAM.

One-quarter ounce diamine gold; ¼ ounce diamine orange B.; 1-16 ounce diamine fast yellow B.

STEEL.

One-eighth ounce diamine gray G.; topped with cyanol extra; aniline gray B.

VICTORIA LAWN

Victoria lawn is a fabric resembling to a great extent a fabric previously explained, linon. It is usually made with slightly heavier yarn in the warp and contains a greater number of ends and picks per inch. It is very firmly woven.

It is especially used for aprons and ladies' heavy undergarments, having excellent wearing and washing qualities.

The usual widths are from 32 inches to 36 inches.

They are made in different grades. Retail prices for some are 12 and 15 cents for the 32-inch width, 23 cents, 27 cents, 32 cents and 38 cents for the 36-inch width.

A typical fabric, weighing about 8¾ square yards per pound, is constructed as follows: 124 ends per inch, 120 picks per inch, 36 inches wide, finished.

CALCULATIONS.

Thirteen square inches of the cloth under consideration weigh 8 grains. To find the number of yards per pound:

$$\frac{13 \text{ (sq. in.)} \times 7{,}000 \text{ (grs. per lb.)}}{8 \text{ (grs.)} \times 36 \text{ (cloth width)} \times 36 \text{ (inches per yard)}} = 8.777 \text{ yards per pound.}$$

To find the average number or count of yarn in the cloth:

$$124 \text{ (ends per inch)} + 120 \text{ (picks per inch)} = 244.$$

$$\frac{244 \times 8.777 \text{ (yds. per lb.)} \times 36 \text{ in.}}{764 \text{ (10\% allowed for contraction and size 764 used instead of 840)}} = 100 \text{ average number.}$$

ANOTHER METHOD

of finding the average number, without taking into consideration the number of yards per pound, is as follows:

Mutiply the sum of the sley and pick by the number of square inches weighed and by .254 and divide by the weight in grains.

This is a simpler method, as will be seen by comparing the number of figures that have to be used in the two methods:

$$\frac{244 \times 13 \times .254}{8} = 100 \text{ average number.}$$

.254 in the above example is a constant obtained by dividing 7,000 (grains) by 36 (inches) and by 764 (yards per hank). The latter is used instead of 840, allowing 10 per cent.

The counts of the yarns are: warp, 85s; filling, 130s.

The weight of the warp yarns may be obtained as follows: 124 (ends per inch) times 36 inches (finished width) equals 4,464. 4,464 plus 40 for selvages equals 4,504, total number of ends in warp.

$$\frac{4{,}504 \times 105 \text{ (length of warp)}}{85 \text{ (counts of warp)} \times 840} = 6.623 \text{ lbs. of warp in 100 yards of cloth.}$$

6.623 plus 5 per cent for size equals 6.954 pounds, weight of warp and size.

To find weight of filling: 120 (picks per inch) times 40 inches (width in reed) equals 4,800 yards of filling in one yard of cloth.

$$\frac{4{,}800 \times 100 \text{ (cloth length)}}{130 \text{ (filling counts)} \times 840} = 4.392 \text{ lbs. of filling in 100 yards of cloth.}$$

6.954 lbs. warp and size.
4.392 lbs. filling.

11.346 lbs., weight of 100 yard piece.
100 ÷ 11.346 = 8.8 yards per pound.

The fabric under consideration, if woven on a dobby loom, could be woven on about 8 harnesses, straight draw, the ends in the body of the cloth being reeded 4 in a dent. The selvage ends work 2 as 1, 2 doubles in 1 dent. The weave is plain throughout. A 12-harness straight draw, the ends reeded 3 in a dent, could be substituted.

LOOM REQUIRED.

The remarks made in connection with the preceding article, linon, also apply here. A single box cam loom, firmly made, one beam, is the best to use. Dobby looms, although capable of weaving goods of this class, are not usually run at as high a rate of speed as cam looms.

FINISHING.

The finishing process includes singeing, washing, bleaching, very light starching, drying and pressing, or calendering.

After a bleaching process, the pieces are given a very good starching with 4 ounces of German white dextrine to a gallon of water, boiled for one hour, and starched through a mangle, and dried over a tenter frame, care being taken to have the goods perfectly straight.

Carding and Spinning Particulars.

The counts of yarn of which Victoria lawn is composed are made in the second and third divisions of mills as given in a previous article. The counts of yarn of which the sample under description is made are 85s warp and 130s filling. Both warp and filling yarns are combed. The cotton used for the filling yarn is 1⅝-inch staple Sea Island stock and that used for the warp is either a long-staple peeler or a 1½-inch Sea Island. We will assume that both yarns are made from Sea Island stock. The cotton would first be opened, as has been previously explained, and put through an opener, and either one or two processes of picking, generally two processes being used; but it is the opinion of a great many carders that

ONE PROCESS IS BETTER

because of the fact that the more picking this cotton is given, the more neps are liable to be put in. The mixing is generally done by hand and not by machine, for the same reason. The cotton should be passed through the opener in the usual manner and should pass on to the lattice apron of the breaker picker, if two processes are used, and from here passed

through the feed rolls and to the action of the beater. This beater is generally of the two-bladed, or armed, type, and for this cotton there should only be made sufficient revolutions per minute to take out the dirt. The speed of the beater is 1,150 revolutions per minute, if two processes of picking are used. The weight of the lap at the front of this picker is 32 pounds, or a 10-ounce lap. These laps are put up and doubled 4 into 1 at the finisher picker, the speed of the beater being 950 revolutions per minute. The beats per minute for this stock are 29. The total weight of the lap at the front is 28 pounds or a 9½-ounce lap to the yard for the 1¾-inch stock and a 10½-ounce lap for the 1⅝-inch stock. A variation of ¼ pound is allowed either side of standard for 1⅝-inch stock and ½ pound for 1½-inch stock. It is understood that every lap must be weighed. The lap is next put up

AT THE CARD

and the draft for the longer staple should not be less than 150 and for the shorter staple 135. The flats should make one revolution every 35 minutes and the speed of the beater should be reduced to 275 revolutions per minute for the same reason as given for the reduction of the speed of the beater of the picker. The counts of the wire used for the fillet should be 35s for cylinder and 37s for doffer and top flats. Special care should be given to the setting and grinding of the fillet for these cards, the wire being always kept sharp. Use the same settings as given in a previous article for this same grade of stock. The

WEIGHT OF THE SLIVER

should be about 35 grains per yard for the 1½-inch stock and 32 for the 1⅝-inch stock. The production is 250 pounds per week of 60 hours for 1⅝-inch stock and 275 to 325 pounds for 1½-inch stock. Both card slivers are taken to the sliver lap machines and doubled 14 into 1 for an 8¾-inch lap. The weight of a yard of sliver lap at this machine is 220 grains. These laps are doubled 6 into 1 at the ribbon lap machine, the weight of the lap being 210 grains per yard for both stocks. The laps of the ribbon lap and sliver lap machines should be weighed once a day and the weights changed at the ribbon lap machine to keep the laps at standard weight. The laps are next put up

AT THE COMBER

and doubled either 6 or 8 into 1, according to the number of heads that the comber contains. The setting and timing of the comber for this stock have been previously given. The draw box rolls should be set from the 1⅝-inch stock as follows. Front to middle, 1 1-16 inches, middle to back, 1¾ inches. It sometimes happens that the draw box will not allow the rolls to be spread this distance, and about the only method to overcome this defect in this machine, as well as in other machines where a like difficulty occurs, is to reduce the draft between the middle and back rolls so that the speed of the rolls will be equal, and set rolls just to staple, which will avoid breaking the cotton; but this has the fault of bringing all the draft between the middle and front rolls. The weight of the sliver at the comber for this stock is 35 grains per yard for both stocks. The percentage of waste taken out for the 1⅝-inch staple is 25 per cent and for the 1½ staple is 22 per cent. This sliver is next put through two processes of

DRAWING.

These drawings should be equipped with leather top rolls, and especial care should be given to the leather top rolls of the sliver lap, ribbon lap, comber and drawing frame machines. The leather detaching rolls of the comber require a somewhat rougher varnished roll than the others, the leather rolls used for the other machines having a smooth, glossy finish. The varnish used for all the rolls should be that which will prevent all licking. The weight of the sliver at the finisher drawing should be 60 grains per yard for both stocks, the doublings at each process being 6 into 1. At the slubber this is made into .80 hank roving. The front top rolls should be of a larger diameter than

those used for shorter staples and should be varnished with a varnish which will give them a smooth, glossy finish. The settings should be 1¾ inches from front to middle and 1⅞ inches from middle to back. The slubber roving is then put through three processes of fly frames and made into 18 hank roving for 1½-inch stock, the hank roving at each process being as follows: 1st intermediate, 2.25 hank; 2d, 5 hank; and fine 18 hank. Sometimes the front rolls of the 1st intermediate fly frame are varnished. This yarn is next put through

THE SPINNING FRAME

and made into 85s on a frame having a 5-inch traverse, 1⅝-inch diameter ring and a spindle speed of 9,400 revolutions per minute. From here it is spooled and warped and put through a slasher. The roving for the filling yarn is put through three processes of fly frames, the hank roving at each process being as follows: 1st, 2.25 hank; second, 7.75 hank, and fine, 24 hank. This is mule spun into 130s and from here is taken to the conditioning room.

BIAZ, OR LINEN FINISH SUITING

Biaz is a medium-grade cotton fabric resembling linen in appearance. This effect is usually obtained on ordinary cotton yarns in the finishing process, or in somewhat easier form, by using mercerized yarns or mercerizing the fabric in the piece. They are usually shown white.

The term biaz is an uncommon one in this country. It is an Asiatic native name, pronounced be'az.

ORIGIN.

The goods are said to have originated at Biaz, a place in the central part of Asia, and to be still manufactured there for home use and for export to Russia. The goods bearing this name are better known in America as "linen finish suitings," and are principally used for ladies' summer suitings. The eastern goods are more heavily filled with foreign matter than ours and are used for various purposes.

ANALYSIS.

The analysis of a typical biaz fabric shows the following data: Ends per inch, 56; picks per inch, 44; finished width, 32.5 inches; weight, 4.57 yards per pound; warp, 19s; filling, 20s; the ends were reeded 2 in each dent. The weight would probably be considered 4½ yards per pound.

CALCULATIONS.

To find number of yards per pound:

A small piece 4 in. x 3 in. weighs 15.7 grs. 4x3 = 12 sq. inches.

$$\frac{12 \text{ (sq. in.)} \times 7{,}000 \text{ (grains)}}{15.7 \text{ (grains)} \times 32.5 \text{ (width)} \times 36 \text{ (inches per yard)}} = 4.57 \text{ yards per pound.}$$

To find average counts of yarn in the cloth:

56 ends + 44 picks = 100.

$$\frac{100 \times 32.5 \text{ (width)} \times 4.57 \text{ (yds. per lb.)}}{764} = 19.4 \text{ average count.}$$

$$\frac{100 \times 12 \text{ (sq. in.)} \times .254 \text{ (constant)}}{15.7 \text{ (grains)}} = 19.4 \text{ average counts.}$$

The sizes of the yarns are about equal. For practical purposes a warp of 19s and a filling of 20s would answer.

LOOM REQUIRED.

This fabric may be made on any of the light, fast running cam looms. On account of the small number of ends per inch a set of two-twine harnesses would be preferable. One warp and one shuttle only are required.

FINISHING.

The finishing of biaz is really the principal characteristic which distinguishes it from many other plain woven cloths. It has a more glossy effect than India linen, one finishing process being somewhat similar to that of the latter fabric, with the beetling process added.

A finish suitable for this cloth is as follows: Bleach, mangle and dry; fill with a light starch on the starch mangle; stretch and dry. After drying and cooling, it is run through the damping machine; then through the glazed calender on both sides, under very heavy pressure. The cloth is then dampened, beetled, changed and turned, and again beetled and made up as required.

Carding and Spinning Particulars.

For biaz the same instructions may be followed as were given in the article on indigo prints, with the following exceptions:

The slubber roving is .50 hank and this is put through two processes of fly frames. At the first intermediate the roving is made into 1.20 hank and at the second into 3.50 hank. This is then passed directly to the spinning room and spun into 19s warp yarn on a frame having a 2¾-inch gauge, two-inch diameter ring, 7-inch traverse; 20.71 twist per inch and a spindle speed of 9,400 revolutions per minute. This is then spooled and warped, after which several warps are put up and run through the slasher and run upon a beam having the required number of ends wanted for weaving. The filling yarn is spun into 20s on a frame having a 2¾-inch gauge, 1½-inch diameter ring, 6½-inch traverse, 14.53 twist per inch, and a spindle speed of 7,300 revolutions per minute, after which the yarn is conditioned.

Dyeing Particulars.

OLIVE.

Five per cent pyrol olive G.; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BRONZE.

Five per cent pyrol bronze G.; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BLACK.

Ten per cent thiogene black M conc.; 10 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt.

SLATE.

One per cent thion black TBC.; 1 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

ECRU.

Three-quarters per cent thion brown G.; 1 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

RED.

Six per cent diamine fast red BB.; 2 per cent sal soda; 25 per cent Glauber's.

BROWN.

Five per cent immedial brown B.; 5 per cent immedial cutch O.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

SKY BLUE.

One and one-half per cent thion blue B conc.; 1½ per cent sulphide sodium; 1 per cent soda ash; 20 per cent salt. Develop with peroxide of hydrogen.

NAVY BLUE.

Eight per cent thion navy blue R.; 8 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt. Develop with peroxide of sodium.

COBURG SUITING

Coburg, of which there are several varieties, may be defined as a thin dress fabric made from cotton and worsted or cotton and silk.

Coburg derives its name from the city of Coburg, in Germany, where it was first manufactured. The all-cotton fabric known as coburg is an inexpensive dress fabric imitating the genuine fabric principally in the character of the weave only.

The weave for these fabrics is an

UNEVEN SIDED TWILL,

giving the face of the goods a very pronounced twill effect. The accentuation of the twill is in part due to the number of ends per inch used in the construction of the goods. The ends per inch in the sample under consideration equal twice the number of picks per inch.

This is somewhat in excess of the number of ends required to make per-

fect cloth. A perfect cloth is understood to mean a cloth in which the warp and filling yarns are equal in diameter, and the space between the threads is equal to the diameter of the yarn. This principle of construction applies particularly to plain woven cotton fabrics, more so than to any other class of fabrics. In fabrics of a special construction, such as coburg, the ends per inch are more or less crowded, with the consequent result

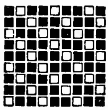


Fig. 1.

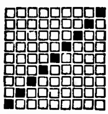


Fig. 2.

of a pronounced twill effect on the face of the fabric, which characterizes the goods.

Cotton coburgs are commonly made with a three-harness twill weave $\frac{2}{1}$ The ends per inch required in order to produce a perfect cloth, according to the above principle of constructing a perfect fabric, with the given counts of yarn, would be as follows:

Weave repeats on three ends with two intersections. Three ends plus two intersections equals 5; as 5 : 3 :: 120, the number of ends that will lie side by side of 1-20s cotton in one inch.

Formula: 5 : 3 :: 120 : x equals 72.

The calculation shows that 72 ends and 72 picks of 1-20s would give a perfect cloth.

In some fabrics an analysis will show 120 ends and 54 picks in the finished fabric. The inequality of ends and picks per inch characterizes cloths of special construction, as the fabric in question. Cotton coburgs are principally used for dress goods, made up into wrappers, shirtwaists, shirtwaist suits, etc. The goods are woven in the gray, then dyed and in most cases printed or bleached and then printed. The goods, however, have no particular coloring scheme or style of printed patterns. Some are finished in pure white or bleached without any printed pattern. Again they may be dyed any color desired. In most cases the goods are dyed and printed. The characters of patterns that are most popular in this class of goods are small geometrical figures or small conventionalized floral figures in but one or, at the most, two colors.

ANALYSIS.

Width in reed, 37½ inches; width, finished, 36 inches. Reed, 1,400 x 3;

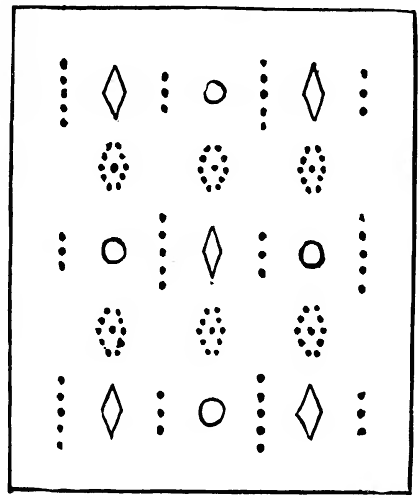


Fig. 3.

number of ends in warp, 4,374; 26 ends selvage; equals 4,400 number of ends.

Number of ends, per inch, finished, 120; number of picks per inch, finisher, 54; take-up in weaving, about 10 per cent; warp yarn, 1-26s cotton, filling yarn, 1-26s cotton.

Fig. 1. Three repeats of weave, twill running to the left.

Fig. 2. Drawing-in draft.

The warp may be drawn in on 6 harnesses; 9 harnesses would avoid

crowding of the harnesses and give better results in weaving.

Fig. 3. A sample of printed pattern.

LOOM REQUIRED.

Common cotton fabrics, as a rule, may be woven on almost any light running high-speed loom. Twill weaves, in which more than four harnesses are required, are usually woven on dobby looms. An automatic dobby loom would answer for the class of goods analyzed. Broken or mispicks in these fabrics are hardly noticeable, the filling showing very little of itself on the face of the fabric.

FINISHING.

The goods are first all boiled off, then dyed or bleached, as may be required, after which they are slightly stiffened by running through a light solution of size, then printed, after which they are made up into laps and then shipped.

Carding and Spinning Particulars.

Under most conditions the same instructions given for indigo prints may be followed. The main point of difference is that of the hank rovings at the slubber and fly frames or speeders. At the slubber the hank roving is .40 and at the first intermediate 1.50, while at the second intermediate it is made into 5.25 hank roving. This roving is then ring spun into 26s for both the warp and filling yarns. For the warp yarn use a frame having a 6½-inch traverse; 1¾-inch diameter ring; 2¾-inch gauge of spindle and a spindle speed of 9,700 revolutions per minute.

THIS YARN

is then run on a spooler, after which the spools are put up and run onto a beam. Several beams are then put up at the slasher, being run through this machine to be sized and run onto a beam at the head end. The filling frame has a 2¾-inch gauge; 1⅜-inch diameter ring; 6-inch traverse; 17.84 twist per inch, and a spindle speed of 8,000 revolutions per minute. After being made, the yarn should be conditioned by putting it into a steam chest or some similar compartment, although some mills merely immerse the full boxes of yarn into a tank of water and take them out immediately.

Dyeing Particulars.

For cotton warp coburgs:

BLACK.

Five per cent union black S.; 30 per cent Glauber's salt.

WINE.

Three and a half per cent diamine Bordeaux B.; 30 per cent Glauber's salt.

LIGHT BLUE.

One and one-half per cent diamine sky blue FF.; ½ per cent diamine steel blue L.; 8 ounces thiocarmine R. powder; 30 per cent Glauber's salt.

NAVY BLUE.

Two per cent diamine black BH.; ¼ per cent naphthol blue black; ¼ per cent formyl violet S. 4 B.; ½ per cent union black S.; 30 per cent Glauber's.

BROWN.

One per cent diamine orange B.; 1 per cent diamine fast yellow B.; ½ per cent union black S.; 1 per cent diamine brown M.; ½ per cent Indian yellow G.; 35 per cent Glauber's salt.

GREEN.

Three per cent diamine green G.; 1 per cent diamine black HW.; 1 per cent diamine fast yellow B.; 30 per cent Glauber's.

SCARLET.

Four per cent diamine scarlet B.; 1 per cent fast scarlet B.; 30 per cent Glauber's salt.

SLATE.

Six ounces union black; 2 ounces naphthol blue black; 1 ounce diamine Bordeaux B.; 2 ounces diamine orange B.; 30 per cent Glauber's salt.

For coburgs, all wool:

For 100 pounds piece goods: Dye with 15 per cent Glauber's salt, 4 per cent sulphuric acid, for light and me-

dium shades; for dark shades add a little more if required.

SLATE.

Four and a half ounces cyanole green B.; ½ ounce acid yellow AT.; 1 ounce azo orseille BB.

RED.

Five per cent naphthol red FB.; 1 per cent orange extra.

OLIVE.

Two per cent cyanole green 6G.; 2½ per cent acid yellow AT.

PEACOCK BLUE.

Two per cent indigo blue SGN.; 1 per cent cyanole extra.

BROWN.

Two and one-half per cent acid yellow AT.; 2 per cent lanafuchsine SG.; ¾ per cent cyanole green 6 G.

SKY BLUE.

One ounce cyanole FF. pat.; ½ ounce acid violet 6 BS.

MAUVE.

One per cent azo wool violet 7 R.; 1 ounce cyanole extra pat.

NAVY BLUE.

Three per cent azo navy blue 3B.; 1¼ per cent azo navy blue B.

BLACK.

Five per cent azo merino black BE.

KID FINISH CAMBRIC

Kid finish cambric is a name given to a soft-finished plain cloth which is fairly lustrous on both sides, but more so on the face than on the back. It is used exclusively for dress linings. It varies in width from about 24 to 27 inches, and is shown in black and staple shades.

The fabric derives its name from its appearance after being subjected to the finishing process.

The cloth itself before finishing does not differ from many other plain cloths now shown on the market. It is fairly well filled with foreign substances; the retail price at which it is sold, about 5 cents per yard for goods 24 inches wide, and the firm feel necessary, preclude the possibility of putting very much cotton into it.

The analysis of a sample under consideration shows the following: Finished width, 25½ inches; ends per inch, 64; picks per inch, 54; warp yarn, 34s; filling yarn, 38s; weight, 8 1-3 yards per pound.

CALCULATIONS.

A sample 4 inches x 3 inches in size weighs 11 grains, indicating a fabric weighing approximately 8 1-3 yards per pound.

$$\frac{2{,}333.33}{11 \text{ grs.} \times 25.5 \text{ in.}} = 8.31 \text{ yards per pound.}$$

Allowing 20 per cent for size and contraction, the average counts of yarns used may be found as follows:

$$\frac{118 \times 25.5 \times 8.31 \times 1.20}{840} = 35.6 \text{ average number.}$$

In the above calculation 118 represents the sum of the sley and pick, 25.5 the width of the cloth, and 8.31 the number of yards per pound.

Assuming the counts of the warp yarns to be 34s, the counts of filling required to make the given weight of cloth may be found as follows:

$$\frac{118 \text{ (sum of sley and pick)}}{35.6 \text{ (average counts)}} = 3.31.$$

$$\frac{64 \text{ (sley)}}{34 \text{ (warp counts)}} = 1.88.$$

$$3.31 - 1.88 = 1.43.$$

$$\frac{54 \text{ (pick)}}{1.43} = 37.7\text{s counts of filling required.}$$

38s filling would be used.

LOOM REQUIRED.

As these goods are not noticed very closely after being made into garments, being hidden when in use, little attention is paid to picking out ordinary misweaves in the loom. Those that are made are covered to a more or less extent in the finishing process.

The chief consideration, therefore, is a large production, which can best be obtained from light running cam looms. Ordinary or automatic looms may be employed, one warp beam and one shuttle only being required. The cloth is reeded one end per heddle and two ends per dent.

This process is really the principal one in making these goods, giving them, as it does, the characteristic name. It gives to the cloth a somewhat leathery feel, not too harsh or stiff, while yet adding a fair amount of foreign matter.

After bleaching, dyeing and mangling, the cloth is dried on the drying machine and allowed to cool. It is then conditioned on the damping machine and allowed to lie for about two hours, after which it is hot swiss calendered on a five-bowl compound lever calender, using light pressure. It is afterward filled on an ordinary two-bowl compound lever starch mangle with a mixture somewhat as follows:

Dextrin	200 pounds
Potato starch or farina	20 pounds
Cornstarch or maize	20 pounds
Oleine oil	2½ gallons
Carbolic acid	½ pint

Water, sufficient to make 120 gallons when boiled. Boil for 15 minutes.

After being filled, the cloth is dried on the drying machine and allowed to cool, then conditioned on the damping machine and allowed to lie at least two hours. It is then hot swiss calendered on a three-bowl dead set calender, using light pressure, after which it is ready for making up.

Carding and Spinning Particulars.

The yarns for the grade of goods under description are made in mills having the equipment of those of the second division. The yarns for this fabric do not have to be combed. They are made from cotton of a middling grade of 1 to 1 1-16 inch staple. This cotton is mixed, as has been previously described. The cotton should be allowed to stand as long as possible after opening before being worked. The cotton is passed through an opener and three processes of pickers. Use the usual precaution in feeding the opener, being sure to keep the pin roller clear of cotton, especially sliver waste, which is apt to wind around this roll on certain makes of openers. After passing through the opener the cotton is fed to the breaker picker. The beaters of all the pickers are of the two-bladed, rigid type. The speed of the beater at the breaker picker is 1,500 revolutions per minute. The total weight of the lap at the front end of the breaker picker is 42 pounds. These laps are doubled 4 into 1 at the intermediate picker, the speed of the beater at this machine being also 1,500 revolutions per minute. The total weight of the lap at the front of this machine is 39 pounds or a 14-ounce lap. The laps are doubled at the finisher picker 4 into 1. The speed of the beater is 1,425 revolutions per minute.

THE TOTAL WEIGHT

of the lap at the front is 40 pounds or a 14½-ounce lap. An allowance of one-half pound either side of the standard total weight of lap is made for this class of goods. At the card the speed of the licker-in should be 350 revolutions per minute. Do not make the card do the work of the picker, but watch to see that the speed of the beater is correct and that the settings of the feed roll and grid and grate bars are right to take out the dirt, seed shells, bits of leaves, etc. It is too often that the licker-in is called upon to do the work that the picker should, and a kick is made that the cards are not doing their duty. The speed of the flats in one complete revolution every 55 minutes. The wire fillet used on the doffer and flats is No. 34s and on the cylinder is No. 35s. Grind and strip cards as described in a previous article. After grinding, the setting points should be all gone over. Do not have the flats too tight or they are apt to cramp and face, if not loosen, the wire on the cylinder. Be always sure to set flats to cylinder by the highest flats, generally five being left for this purpose. The weight of the sliver should be about 50 grains per yard and the production 750 to 900 pounds per week of 60 hours.

THE CARD SLIVER

is put through three processes of drawing, the doublings being 6 into 1. The speed of the front roller should be about 400 revolutions per minute if leather is used, and 350 revolutions per minute if metallic top rolls are used. The drawing should be sized at least twice a day and four times a day is

better. The setting of the bottom steel rolls should be especially looked after, as well as the knock-off motions, to see that no single is allowed to pass. If these motions are not in perfect working order single will be allowed to pass, which will throw your numbers all out and cause a great deal of trouble to remedy. When changing the draft to change weight, always have same size draft gear on machines running the same kind of work. The weight per yard of the sliver is 70 grains. The drawing sliver is drawn into .60 hank roving at the slubber. Watch

THE TRAVERSE MOTION

to see that it is in working condition. After passing the slubber, the roving is passed through two processes of fly frames, the hank at each process being 2 at the first and 6.50 hank at the second for the warp yarn and 8 hank for the filling yarn. Size these yarns once a day and be sure to keep them on the mark. Watch the build of bobbins, traverse motion, rolls and setting of same. The roving for warp yarn is made in 34s on a frame with a 1⅜ inch diameter ring, 6½-inch traverse, 27.70 turns per inch and spindle speed of 10,200 revolutions per minute. The yarn is then spooled, warped and slashed. The filling is spun into 38s on a frame having a 1⅜-inch diameter ring, 5½-inch traverse, 23.12 twist per inch and spindle speed of 8,800 revolutions per minute.

Dyeing Particulars.

PINK.

Four ounces Erika G.; 15 pounds Glauber's; 2 pounds sal soda.

LIGHT BLUE.

One-half per cent diamine sky blue FF.; 15 per cent Glauber's; 2 per cent sal soda.

MAUVE.

One-half per cent diamine violet N.; 15 per cent Glauber's; 2 per cent sal soda.

LIGHT SLATE.

One-quarter per cent diamineral blue R.; 1-16 per cent diamine fast yellow B.; 10 per cent Glauber's; 2 per cent sal soda.

LIGHT FAWN.

One-quarter per cent diamine catechine G.; ⅛ per cent diamineral brown G.; 10 per cent Glauber's; 2 per cent sal soda.

SLATE.

One and one-half per cent diamine black BH.; ¼ per cent diamine fast yellow B.; 20 per cent Glauber's; 2 per cent sal soda.

PEA GREEN.

One-half per cent diamine green G.; 10 per cent Glauber's; 2 per cent sal soda.

ECRU.

One-eighth per cent diamine catechine 3 G.; ⅛ per cent diamine catechine B.; 10 per cent Glauber's; 2 per cent sal soda.

ROYAL BLUE.

Two per cent diamine blue 3R.; 2 per cent diamine brilliant blue G.; 20 per cent Glauber's; 2 per cent sal soda.

SEAL BROWN.

Two per cent diamine catechine B.; 2 per cent diamine catechine G.; 20 per cent Glauber's; 2 per cent sal soda; 1 per cent diamine fast yellow A.

WINE.

Five per cent diamine Bordeaux B.; 2 per cent sal soda; 20 per cent Glauber's.

RED.

Four per cent diamine fast red 2 B.; 2 per cent sal soda; 15 per cent Glauber's.

NAVY BLUE.

Five per cent diamine black BH.; 1 per cent diamine brilliant blue G.; 20 per cent Glauber's; 2 per cent sal soda.

BLACK.

Three per cent diamine jet black OO.; 3 per cent diamine jet black SS.; 30 per cent Glauber's; 2½ per cent sal soda.

BOTTLE GREEN.

Five per cent diamine black HW.; 2 per cent sal soda; 20 per cent Glauber's; 2 per cent diamine fast yellow B.

BEIGE

Under the head of beige is a class of dress goods, the characteristic of which is their mottled or mixed effect. This effect is brought about by various methods. The method used in producing the effect largely influences the quality of the fabric, but the general appearance remains the same.

We will describe beige as made by three different methods: First, this fabric is originally made of yarns spun from wool dyed in the stock; this dyed stock is then mixed with undyed stock, then spun into a thread; generally several mixtures go into one fabric.

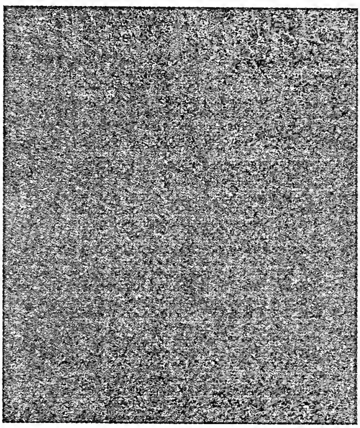


Fig. 1.

These mixtures of dyed and undyed stock are varied. The proportions used may be 50 per cent of each; another mixture may have a more or less percentage of either stock; and another mixture may be composed of still a different percentage from the first two.

The threads then spun from these mixtures are arranged in some order in the warping and also in the weaving, producing what are commonly known as indefinite plaid effects in connection with the mixed or mottled effects.

THE SECOND METHOD

is to use a combination of twist yarns, usually three or four different colored threads, as, for example, black and white, black and slate, slate and white, and the other may be a pearl and white. These combinations of threads may be arranged similar to the arrangement in the first method, likewise producing an indefinite plaid effect. The use of black and white, slate and white, and colors of similar shades, produces gray effects. Grays and browns are the prevailing colors in this class of goods. The colored yarn used in this particular class is usually worsted, while the white in most cases is a cotton thread.

THE THIRD METHOD

of producing this mixed or mottled effect is brought about by printing the goods.

This method is usually practiced on the cheaper grade of goods, goods composed entirely of cotton yarn; the effect, however, imitates very closely the wool dyed in the stock fabric or the goods composed of twist yarns. In the finer grade of fabrics the twill weave is much in evidence, whlie the cotton goods are mostly woven plain. The plain weave is more adapted to the particular character of printing; in order to give the plaid effect in connection with the mixed or mottled appearance, the goods are subjected to two processes of printing:

ANALYSIS OF COTTON BEIGE.

Width of warp in reed, 38 inches; width of fabric finished, 36 inches; reed, 1,000 by 2; number of ends in warp, 2,076; 28 ends each selvage equals 56; total ends in warp, 2,132. Number of ends per inch finished, 60; picks per inch finished, 48; take-up of warp during weaving, 12 per cent; warp and filling yarn 1-26. The 1,000 reed means 1,000 dents in 36 inches of reed. The 2,076 is the number of ends in warp without the selvage.

Fig. 1. Sample of fabric as produced by means of twist yarns; the fabric is plain woven.

LOOM USED.

For the better grade of fabrics the pick and pick loom is required to give the best effects. The goods woven pick and pick will be less inclined to appear stripy; this effect would be undesirable; the stripes should be of an indefinite nature.

The sample of fabric shown in Fig. 1 is woven on a 4 x 1 box loom, in which no less than two picks of one color must be woven before it changes onto the next color; unless the colors are carefully graded they will produce a fabric more or less striped. In the printed cotton beige fabric a single box loom fills the requirements. This grade of goods is woven with undyed yarns; the effect, as already mentioned, is produced by the printing machine after the goods are woven.

FINISHING.

The cotton fabric, after it is woven, is boiled off, after which it is slightly stiffened, then subjected to the printing machine, after which it is pressed, then made up into laps or rolls and then shipped.

Carding and Spinning Particulars.

Beige is a dress goods generally made from wool and sometimes of wool and cotton, other grades being made from all-cotton yarns. The cotton is dyed in the stock. Some of the grades of beige are made from combed yarn, whereas other grades are made from carded yarns. The staple of the cotton does not exceed 1 1-16 inches in length for an American cotton. Mix cotton as has been previously stated. Three processes of pickers are used, the particulars being the same as given for etamine. The particulars for the cards and drawing frames as given in that article may also be followed.

AT THE SLUBBER

the drawing sliver is made into .60 hank roving, and is then put through two processes of fly frames or speeders, the hank roving at the first intermediate being 1.75 and at the second intermediate 5 hank. Speeders should be looked after to see that the rolls are properly set; that top rolls are in good condition; that there are no dead spindles; that the spindles are oiled once a day; the build of bobbin correct; traverse motion working properly, and frame at all times clean and neat. The bobbins when doffed should not be thrown into doffing box or truck, but should be packed in. The boxes or trucks should be cleaned out before doffing. After changing a frame from one kind of work to another the new roving should be sized and tested for twist, and the tension watched. After the speeders the yarn is put through

THE SPINNING FRAME,

where the proper colors of yarns are doubled together and spun into 26s yarn, the warp frame having the following particulars: Length of traverse, 6½ inches; diameter of ring, 1¾ inches; gauge of frame, 2¾ inches, and spindle speed of 9,700 revolutions per minute. The yarn is then spooled, warped and slashed. For the filling frame use a 2¾-inch gauge of frame; 1⅝-inch diameter ring; 6-inch traverse and a spindle speed of 8,000 revolutions per minute; the diameter of the front bottom steel roll of spinning frames being one inch for both warp and filling.

Dyeing Particulars—Yarn Dyeing.

NAVY BLUE.

Four per cent naphtamine blue 2 B.; 30 per cent Glauber's; 2 per cent sal soda.

MEDIUM BROWN.

Three per cent naphtamine brown N.; 1 per cent naphtamine yellow NN.; 20 per cent salt; 2 per cent sal soda.

RED.

Four per cent diamine fast red BB.; 25 per cent salt; 2 per cent sal soda.

DARK BROWN.

Four per cent naphtamine brown 6 B.; 25 per cent salt; 2 per cent sal soda.

SLATE.

One and one-half per cent naphtamine black D.; 20 per cent salt; 2 per cent sal soda.

OLIVE.

Three and one-half per cent naphtamine olive R.; 20 per cent salt; 2 per cent sal soda.

GREEN.

Six per cent immedial green GG.; 6 per cent sulphide soda; 2 per cent soda ash; 25 per cent Glauber's.

DARK BOTTLE GREEN.

Eight per cent immedial green; 8 per cent sulphide soda; 2 per cent soda ash; 25 per cent salt.

ECRU.

One-half per cent diamine catechine G.; 20 per cent salt; 2 per cent sal soda.

BLACK.

Ten per cent immedial black NN.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

MAROON.

Six per cent immedial Bordeaux G.; 6 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

LIGHT BLUE.

Six per cent immedial sky blue FF.; 6 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

Printing Particulars.

Cotton beige is also printed on the piece. To get a good imitation of the woven fabric, it has to be printed on both sides of the piece. After printing one side of the fabric and drying, the pieces are rolled up on a roller and the other side of the piece is printed, so that both sides of the piece present the same appearance. The goods are given a soft finish to imitate a piece of dress goods. The colors printed on are made as fast as possible, so that the goods can be washed when required.

The goods are printed, dried and steamed in a Mather and Platt at 212 degrees F., excluding the air as far as possible. Wash in cold water, soap lukewarm, rinse and dry.

BLUE.

Seventy parts immedial indone BN.; stir well to a paste with 20 parts caustic soda lye, 77 degrees Tw.; 50 parts glycerine; then add 150 parts reducing paste A. The whole is heated for some time to 140 degrees F. and cooled; stir in 80 parts China clay; 60 parts saturated solution of common salt; 570 parts alkaline gum thickening.

GREEN.

Ninety parts immedial green GG.; 300 parts alkaline gum thickening; 40 parts China clay; 30 parts saturated common salt solution; 150 parts reducing paste A.; mix and stir; when cool add 40 parts China clay; 30 parts saturated common salt solution; 320 parts alkaline green thickening.

BLACK.

Seventy parts immedial black NLN.; 150 parts reducing paste A.; heat together to 120 degrees F.; allow to cool down, then stir in a mixture of 160 parts China clay; 120 parts saturated solution of salt; 500 parts alkaline gum thickening.

BROWN.

Mix as the blue with 70 parts immedial brown B.; 10 parts immedial yellow D.

DARK SLATE.

Thirty parts immedial black NB.; mix as the green.

LIGHT SLATE.

Ten parts immedial black NG.; 2 parts immedial direct blue B.; mix as the green.

ECRU.

Five parts immedial yellow D.; 2 parts immedial cutch G.; mix as the green.

OLIVE.

Fifty parts immedial olive B.; 20 parts immedial bronze A.; mix as the green.

BRONZE.

Forty parts bronze A.; 10 parts cutch G.; mix as the green.

FAWN.

Fifty parts immedial cutch O.; 10 parts immedial brown RR.; mix as the green.

LIGHT BLUE.

Forty parts immedial sky blue; mix as the green.

POPLIN

Poplin is a name given to a class of goods distinguished by a rep, rib, or cord effect running width way of the piece. It referred originally to a fabric having a silk warp and a figure of wool filling heavier than the warp. At the present time it refers more to a ribbed fabric than to one made from any particular combination of materials.

Cotton poplin is usually made with a plain weave, the rep effect being obtained either by using a fine warp, as compared with the filling, or a large number of ends, as compared with picks per inch, or both.

IRISH POPLIN,

made principally in Dublin, is a fabric made of China organzine silk warp and colonial wool filling. The manufacture of this cloth has continued in Dublin since 1693, when a number of Huguenot silk weavers emigrated from Lyons, France. The industry is still carried on there to some extent on hand looms, the weavers owning their own looms. The materials are supplied by the firms for whom they work and are given out ready for weaving. The Irish poplin is a light-weight variety of poplin, sometimes called single poplin, and is celebrated for its uniformly fine and excellent wearing qualities.

Brocaded poplin is made with elaborate jacquard designs of various types.

TERRY POPLIN

is a very durable fabric, made on the principle of cloth construction explained in the article on "Terry Pile Fabrics." By throwing to the surface alternate ends of the silk warp an appearance somewhat resembling terry velvet is obtained.

The bulk of cotton poplin goods are woven and finished white. Poplins formerly were woven from yarns which had previously been bleached or dyed, as the case may be, but to-day these fabrics are largely made from grey yarns and then bleached and piece dyed. The construction of such fabrics is not widely different from that formerly noted, but the product is undoubtedly made more economically and the colors produced are just as satisfactory, if not more so, than those on some of the older styles of goods. A large proportion of the poplin fabrics made from combed yarns are piece mercerized, for this makes a luster on the cloth, and creates a greater sale. Some fabrics are made with combed warp and carded filling, others from all combed stock, while others are entirely carded material. The fabrics are mercerized in the warp direction, and the warp yarn is soft twisted to aid in producing a high luster. Because the yarn is soft twisted, it is a general policy to have it two-ply, that is, 60-2 soft twist warp will be used in place of 30-1. It used to be true that the heavy filling and rather light warp did not take the dye evenly, and while there is a certain amount of objection to-day because of this fact, nevertheless the results are satisfactory in the majority of instances.

For a given length of poplin cloth a much greater length of warp is required than for an equal length of cloth where the warp and filling yarns and ends and picks are practically equal, because the coarse filling lies in the cloth in practically a straight line, the warp yarns having to do all the deflecting.

The analysis of a typical cotton poplin of good quality shows the following data: Ends per inch, 104; picks per inch, 48; finished width, 27 inches; weight about 6 yards per pound; warp yarns, 2-68s; filling yarns, 2-60s. Plain weave.

CALCULATIONS.

To find number of yards per pound: 2½ yards weigh 2,940 grains.

$$\frac{7{,}000 \text{ (grs. per lb.)} \times 2.5 \text{ (yds.)}}{2.940 \text{ (grs.)}} = 5.95, \text{ say, } 6 \text{ yards per pound.}$$

To find average counts of yarn, assuming the warp yarn to have contracted 10 per cent in length from warp to finished cloth, and the filling 4 per cent in width:

104 (ends) divided by .90 .... 115.55
48 (picks) divided by .96 .... 50.00

165.55

$$\frac{165.55 \times 27.5 \text{ (width)} \times 6 \text{ (weight)}}{840} = 32.5 \text{ average counts.}$$

In dealing with the preceding calculations it has been considered that the yarns were mercerized before being woven, and the counts indicated after mercerizing. The mercerizing process tends to contract the length of yarn to a greater or less degree, depending upon the quality of the yarn, the mercerizing liquor, and the machinery used. If mercerized under tension, there is not a very large contraction, but if the yarn is allowed to contract it may do so to the extent of 20 to 30 per cent, that is, a cotton yarn spun to 50s may contract in the mercerizing bath to 40s or 35s yarn.

Both warp and filling in the sample under consideration are mercerized, and are 2-ply yarns of good quality.

To find the counts of filling required to give the stated weight, assuming the warp yarn to be 2-ply 68s:

165.55 divided by 32.5 (ave. counts) 5.09
115.55 (sley) divided by 34 (warp counts) 3.39

1.70

Fifty divided by 1.70 equals 29.4 equals 2-59s filling required. The counts would be indicated as 2-60s.

The selvages consist of eight double ends on each side.

To find number of ends in warp:

104 (ends per inch) x 27.5 (cloth width) = 2,860.
2,860 + 16 for selvage = 2,876, total ends.

To find weight of warp in 100 yards of cloth.

$$\frac{2{,}876 \text{ (ends)} \times 100 \text{ (yards)}}{840 \times 34 \text{ (counts)} \times .90 \text{ (10\% (contraction)}} = 11.18 \text{ lbs. warp.}$$

To find weight of filling in 100 yards of cloth:

$$\frac{48 \text{ (picks)} \times 27.5 \text{ (cloth width)} \times 100 \text{ (yds).}}{840 \times 30 \text{ (counts)} \times .96 \text{ (4\% contraction)}} = 5.45 \text{ lbs. filling.}$$

To find weight of 100-yard cut:

11.18 lbs. warp.
5.45 lbs. filling.

16.63 lbs. yarn in 100 yards of cloth.

To find number of yards per pound:

100 ÷ 16.63 = 6 yards per pound.

LOOM REQUIRED.

For plain weave poplins an ordinary plain cam loom is required, one warp and one filling being sufficient. It is not advisable to use automatic looms unless the same are equipped to change the cop or bobbin before the preceding one has spent itself, because a mispick is one of the defects that shows most prominently in this class of goods.

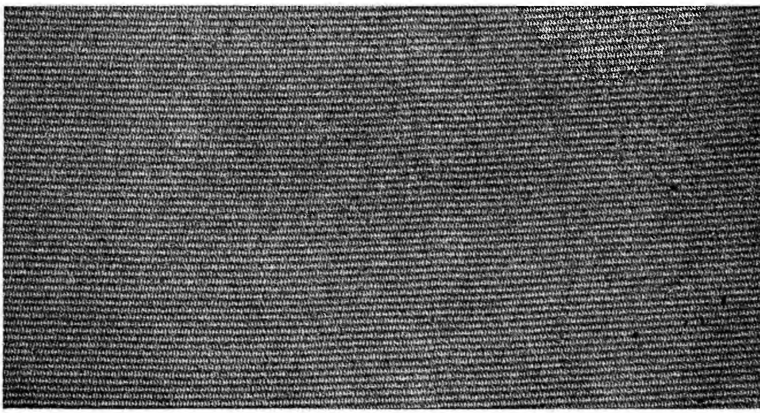
FINISHING.

The fabric under consideration, having been bleached and mercerized in the yarn, requires very little after-treatment. It is washed, conditioned, calendered lightly and made up, book fold.

The finishing of any fabric depends largely upon the methods through which it was produced. If a poplin is produced with dyed and mercerized yarns, such as is noted on drapery materials and similar articles, there is very little description necessary regarding the finishing processes. The fact that many poplins are now made from grey yarns makes the finishing much different from that upon the yarn dyed material. The fabric is usually mercerized in the grey state, then bleached and dyed the color which is desired. Large quantities of these fabrics have been sold, in fact it is considered one of the staple articles in the trade to-day.

Carding and Spinning Particulars.

When making the yarns for poplin the same particulars may be followed as have been previously given in the article on "Lawn." For this particular grade of poplin the warp yarn is 2-68s and the filling yarn 2-60s. Use the instructions given for making 60s warp yarn, with the following exceptions. The spinning frame for the warp yarn would be as follows: For making 68s warp yarn, 1⅝ inches diameter of ring; 5½ length of trav-



Poplin.

erse, and spindle speed of 10,000 revolutions per minute. This yarn is then spooled and twisted into 2-ply, the twist put in being 39.17 turns per inch. After being twisted, the yarn is warped and slashed. For spinning the 60s filling yarn use a frame having a 1¼-inch diameter ring, 5-inch traverse, 27 twists per inch and a spindle speed of 8,000 revolutions per minute. This yarn is spooled and twisted into 2-60s, after which it is conditioned and is then ready for use.

Dyeing Particulars.

BRONZE.

Five per cent pyrol bronze; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

GREEN.

Six per cent pyrol green G.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BLUE.

Six per cent pyrol blue B.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

ECRU.

One-half per cent immedial catechine G.; 1 per cent sulphide sodium; 2 per cent soda ash; 10 per cent salt.

OLIVE.

Two per cent immedial indone B.; 6 per cent immedial yellow D.; ½ per cent immedial catechine G.; 9 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt.

WINE.

Eight per cent diamine Bordeaux B.; 2 per cent sal soda; 25 per cent salt.

RED.

Five per cent diamine fast red B B.; 2 per cent sal soda; 25 per cent salt.

NAVY BLUE.

Eight per cent katigen indigo B.; 8 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

SLATE.

One per cent thion black T B.; 2 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

SKY BLUE.

One per cent diamine sky blue F F.; 1 per cent sal soda; 10 per cent salt.

SEA GREEN.

One-half per cent immedial green B.; 1 per cent sodium sulphide; 2 per cent soda ash; 10 per cent salt.

COTTON-MOHAIR FABRICS

Mohair fabrics, commonly so called, are used exclusively for dress goods, in the form of tailor-made suits, skirts, children's coats, etc.

The name, mohair, is acquired from the material used in the construction of the fabric. This material, mohair, the product of the Angora goat, is used principally in the filling only; the warp may be cotton, worsted, or silk, according to the quality of fabric wanted.

The characteristics of mohair fabrics are their crispness and glossy appearance. These features are effected by the mohair. Mohair, like wool, is an animal fibre, but differs from the latter in so far that the fibres are longer and coarser than wool, and mohair is not as soft or as crinkled as wool; in brief, it may be described as a long, straight, glossy animal fibre. These fabrics

VARY CONSIDERABLY

in regard to quality, style and width, but all are plain woven fabrics. Some are elaborated into spot patterns by means of the filling floating over a given number of ends in some geometrical form.

Again, the spots may be formed by the use of an extra warp. This warp floats on the back of the fabric for a given space, then comes to the face for a required number of picks. This extra warp is usually mercerized, the yarn differing in color from the body of warp and being arranged in groups of two or more ends across the entire breadth of warp. These groups of threads may alternate, as, for example, one group may be yellow, the next green, another red or any color that may strike the fancy of the designer, providing that the color thus used produces some degree of harmony. This will give plenty of variety to the fabric, and if these various groups of threads are made to work on some sateen or broken twill order, they will give the appearance of a large de-

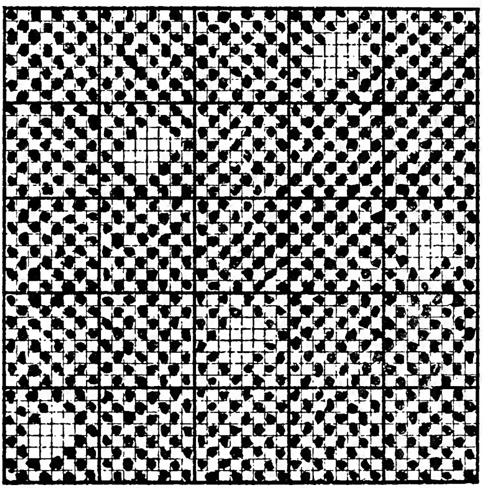


Fig. 1.

sign, or, as generally mentioned, a jacquard effect. In filling floated fabrics, it is most important that the distribution of the figure should be so that the eye is not attracted by lines formed by the unequal distribution of the figure. This objectional feature is most likely to occur in designs of this character. It is somewhat difficult to tell if the distribution is perfect without extending the design for four or even more repeats. In designs which consist of set figures, the difficulty of arrangement is somewhat eliminated by arranging the figure on some irregular sateen basis, the irregular sateen being preferred to the regular sateen basis as the former gives a somewhat stiff appearance, the latter giving a mixed effect more suitable for this class of fabrics. Figure 1 shows one repeat of the design the spot based on a 5-harness sateen order. Figure 2 shows one repeat of figure based on $\frac{1}{3}$ broken twill. Figure 2 presents a more mixed effect than Figure 1.

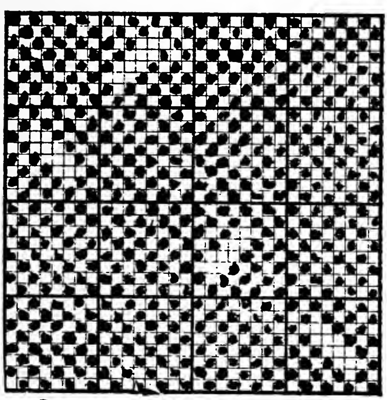


Fig. 2.

Considerable quantities of mohair are woven plain throughout. In this style of fabrics the ornamentation, if such is desired, is effected by means of twist or fancy colored threads arranged in some order, usually in the warp only, though a similar arrangement may be carried out in regard to the filling. These fancy colored threads may be arranged in almost any way possible; the object, however, is to have a fine hair-line stripe throughout the entire length of fabric. Still another method of breaking the monotony of a plain fabric is to skip a dent in the reed at certain intervals; this may be carried out with fancy colored threads if desired. These fabrics, as mentioned above, are made in various qualities. We will here deal with the cotton warp and mohair filling fabric. This particular class is usually piece-dyed. The warp, however, is dyed before it is beamed. When twist yarn is used, that is, a twist composed of two different colored threads, one of the two threads in some fabrics is a worsted thread; when such is the fact, the warp is not dyed until woven into the fabric; the cotton end composing one of the twist threads will not take the color in a worsted dye. When cotton only is used in the twist one of the threads is dyed before it is twisted, that is, if a colored and white thread is to be the twist wanted.

ANALYSIS OF COTTON MOHAIR.

Width in reed, 60½ inches; width finished, 54 inches; ends per inch in reed, 44; ends in warp, 2,660; ends in selvage, 78 (39 each side, 3 in a dent); total ends, 2,738; reed, 44 x 1.

Dressing	2 ends black
	1 end black, white
	2 ends black
	1 end black, white
	2 ends black
	1 end black, white
	2 ends black
	1 end black, white
	2 ends black
	2 ends black, white
	16

Ends in warp.

1,664	black cotton	10 2-80
996	black white cotton	6 2-80
78	bleached cotton	0 2-80
2,738		16

Filling 1-15s mohair, 48 picks.

LOOM REQUIRED.

The plain mohair, or the fabric in which the ornamentation is effected by means of fancy colored threads, may be woven on any light-weight loom; the roller, dobby or automatic loom may be used to advantage. The loom could make better cloth if it had a

warp stop-motion, as it is very important that no ends be left out in the weaving; if they are, they must be sewed in before the fabric is finished, thus entailing another expense.

Fancy figured mohair requires the use of a jacquard loom, on account of the number of ends in the repeat of the pattern, which would be too great for the dobby loom.

The warp for mohair fabrics is reeded one end in one dent, and woven with considerable tension on the warp beam.

FINISHING.

After the fabric is woven it is examined and mended if necessary, then scoured, after which it is dyed. These fabrics are dyed in various colors and shades. After the dyeing process, the fabrics are sheared on the face, then doubled and made up into rolls, ready for the market,

---

Carding and Spinning Particulars.

Mohair is composed of all mohair or a cheaper grade which is made up of mohair and cotton. The count of the yarn used for the sample under description is composed of 1-15s mohair filling and 2-80s warp yarn. The yarn for the warp is made in cotton mills of either the first or second division as classified in a previous article. The yarn is made from an American cotton, either peeler or Allen seed being used. The staple is 1½ inches, and cotton should be of a good grade. As this cotton is apt to be very dirty, it is generally put through an opener and three processes of picking.

THE MIXING

should be as large as possible, and if possible the mixing should be allowed to stand for at least three days before using, so that it may dry out and expand. If this is done it will be found that the cotton is easier to work and the dirt will be taken out very much easier. At the mixing be sure that the grades of the cotton of each bale are the same and do not under any circumstances use a creamy bale. Each bale should be stapled before being put into the mix to see that it is up to staple. Keep the hopper of the opener well filled with cotton, so as to obtain as even a feed as possible. The

SPEED OF THE BEATER

at the breaker picker for this stock is 1,450 revolutions per minute, the beater used being of a two-bladed type. The weight of a 40-yard lap at the front of the breaker is 40 pounds or a 16-ounce lap. At the intermediate picker, the speed of the beater should be 1,400 revolutions per minute, the lap at the front weighing 37½ pounds or a 12-ounce lap. At the finisher picker the speed of the beater is 1,350 revolutions per minute. The total weight of the lap is 35 pounds or a 12½-ounce lap. At the finisher picker the good waste laps, or, as they are sometimes called, cut-roving waste laps, are mixed in with the raw stock, one lap cut waste to three laps of good cotton. In mills that do not have a roving waste picker it is

THE GENERAL CUSTOM

to take out the middle two laps and spread the cut waste evenly in this span and use up the waste in this manner. These laps are sometimes put up at the cards, but the general custom is to put them through the finisher picker again in the proportion named above. A variation of not more than one-half a pound either side of standard is allowed, every lap being weighed. If the laps weigh over or under this allowance they should be run over again. This point cannot be looked into too closely, and it will save a lot of trouble in the evenness of the numbers at the fine frames and in the spinning room. The laps from the picker are put up

AT THE CARD,

the speed of the licker-in being 350 revolutions per minute; speed of flats, one complete revolution every 45 minutes (110 flats). The cards should be properly set, ground and stripped at least three times a day. Keep the wire sharp at all times, and it is a good plan to grind the flats on a special grinding machine for flats, they being taken off the cards for this purpose. The weight of the sliver at the

card is 45 grains per yard. As the sliver is to be combed, the card sliver is put up at the sliver lap machine, where it is doubled 14 into 1 (i. e., for an 8¾-inch width lap). The weight of a yard of lap at the front is 290 grains. These laps are put up at the ribbon lap machine and doubled six into 1, the weight of a yard of lap at this machine being 275 grains. These laps are put up at the comber and doubled according to the number of heads the comber has. The percentage of waste taken out at this machine is 18 per cent. The weight of the sliver is 35 grains per yard. This sliver is put through two processes of

DRAWING FRAMES,

the doublings at each process generally being 6 into 1, although some mills double 8 into 1 at the breaker and 6 into 1 at the finisher. The weight of the sliver at the front of the finisher drawing should be 70 grains per yard. Either metallic or leather top rolls may be used for this class of work, generally the latter being used. See that the leather top rolls on all machines are in perfect shape and well varnished; size the ribbon laps at least once a day and drawing frames four times a day. The drawing sliver is put up at the slubber and drawn into .55 hank roving, after which it is put through three processes of fly frames, the hank roving made at each process being as follows: First intermediate, 1.50; 2d, 4.50 and fine frame 16 hank. This yarn is taken to the spinning frame and spun into 80s on a frame with a 2¾-inch gauge of frame, 1⅝-inch diameter ring, 5½-inch traverse and spindle speed of 9,600 revolutions per minute. This yarn is then spooled and twisted into 2-ply 80s yarn, many times two different colored yarns being twisted together. The yarn is then respooled and run upon a beam, after which the beams are put through the slasher and sized.

Dyeing Particulars.

MEDIUM BROWN.

Three per cent naphtamine brown N.; 1 per cent naphtamine yellow NN.; 20 per cent salt; 2 per cent sal soda.

DARK BROWN.

Four per cent naphtamine brown 6 B.; 25 per cent salt; 2 per cent sal soda.

SLATE.

One and one-half per cent naphtamine black D.; 20 per cent salt; 2 per cent sal soda.

OLIVE.

Three and one-half per cent naphtamine olive R.; 20 per cent salt; 2 per cent sal soda.

DARK BOTTLE GREEN.

Eight per cent immedial green; 8 per cent sulphide soda; 2 per cent soda ash; 25 per cent salt.

BLACK.

Ten per cent immedial black NN.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

MAROON.

Six per cent immedial Bordeaux G.; 6 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

HERRINGBONE STRIPES

Herringbone stripes are certain weave effects resembling herringbones. They are developed to the greatest extent in men's wear fabrics, woolens, worsteds, cotton worsteds and all cottons, although in these goods the arrangements of various colors in the warp yarns form one of the principal component parts of the pattern. Herringbone weaves in ladies' dress goods are usually shown in white.

These weaves are a development of ordinary twill weaves in which the twills, instead of running in one unbroken line diagonally across the piece, run for a certain number of ends one way and a certain number of ends in the reverse direction, thus breaking the continuity of the twill. They differ from wave effects in having the two ends defining the turning points of the twill arranged to work opposite each other, i. e., when one is raised the other is depressed. This may be

seen at the points indicated by the daggers in Figs. 1 to 5.

The foundation twills principally used when developing these weaves for men's wear goods are the even flushed twills $\frac{2}{2}$ and $\frac{3}{3}$, Figs. 6 and 7, the former forming the greater proportion. Figs. 1 to 5 show some of the other weaves used, the number of ends in each section and the number of sections in a repeat being made to vary according to requirements. The daggers indicate the cutting points.

Although the principle may be extended to large weaves, it is seldom that the effects are made from a weave base greater than eight ends and eight picks.

Fig. 8 illustrates a herringbone effect in a cotton cloth made with weave Fig. 1. In the gray the warp appears to stand up from the cloth in the sections weaving $\frac{2}{1}$ on the face. This prominent effect is modified in the finished cloth.

Fig. 8 is one of a line or range of patterns made and finished in England, for sale in northwest Africa. The construction of the cloth is as follows: width in gray, 30½ inches; ends per inch, 68; picks per inch, 72; warp, 35s; filling, 48s; yards per pound, 7.72, say 7¾. The ends have been reeded equally throughout, 2 ends per dent. The selvages consist of 12 ends of 2-ply 30s yarn on each side.

CALCULATIONS.

To find number of ends in warp:

68 (ends per inch) x 30½ (inches) = 2,074 ends.
2,074 + 24 (selvages) = 2,098 ends in warp.
24 2-ply yarns represent 48 single yarns.

In the above calculation 24 of these were considered when multiplying the ends per inch by the width, leaving but 24 to be added.

To find weight of warp:

$$\frac{2{,}098 \text{ (ends)} \times 105 \text{ (yds.)}}{840 \times 35} = 7.05 \text{ lbs. warp.}$$

To find weight of filling:

$$\frac{72 \text{ (pks.)} \times 33 \text{ in. (width in reed)} \times 100 \text{ (yds.)}}{840 \times 48} = 5.89 \text{ lbs. filling.}$$

To find number of yards per pound:

7.05 lbs. warp.
5.89 lbs. filling.

12.94 lbs. weight of cut.
100 (yds.) ÷ 12.94 = 7.72 yards per pound.

The finished fabric has been heavily sized or filled, giving but 6 2-3 yards per pound.

LOOM REQUIRED.

The class of goods under consideration is generally woven on fast running, side cam, single box looms. One warp only is required and the goods are reeded equally throughout.

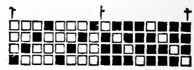


Fig. 1.

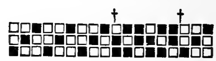


Fig. 2.

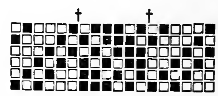


Fig. 3.

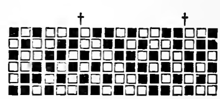


Fig. 4.

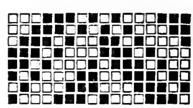


Fig. 5.

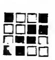


Fig. 6.

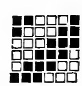


Fig. 7.

FINISHING.

This fabric has been subjected to the "back filled" process of finishing. This consists of bleaching, mangling,

drying, damping, calendering, stretching and filling. The mixture for back filling is composed of wheat starch, farina, China clay, oleine oil, cocoanut oil, bluing, carbolic acid and water. After being filled, it is dried, dampened, calendered and made up as required.

Carding and Spinning Particulars.

The yarns of which herringbone stripes are composed are made in mills of the second division, as given in a previous article. The count of the yarns put into this style of fabric varies, and for this article we will consider that the count of yarn used is 35s for warp yarn, 48s for filling and 30s for selvage. The staple of the cotton used for the 30s and 35s yarn is 1⅛-inch and for the 48s is 1 3-16-inch of middling grade.

THE MIXINGS

should be as large as possible, so that as little variation as possible will be found between the different mixings, and also there should be two mixings of the same length of staple, one being used while the other is being worked. If the mixing is put through a bale breaker one mixing may be done away with. This is so that the cotton will be allowed to expand as much as possible before being put through the pickers. An opener and three processes of pickers are generally used for both lengths of staple. Follow the rules already given in connection with the openers. At the breaker picker the speed of a two-bladed, rigid type of beater is 1,500 revolutions per minute and of a three-bladed beater is 1,000 revolutions per mniute. If a pin beater is used the speed is 1,200 revolutions per minute. The total weight of the lap at the front of this picker is 40 pounds. The laps are put up at the intermediate picker and doubled 4 into 1. The speed of a two-bladed beater at this machine is 1,450 revolutions per minute, a three-bladed beater, 950 and a pin beater, 1,100 revolutions per minute. The total weight of a lap at the front of this machine is 38 pounds or a 14-ounce lap for both stocks. These laps are put up at the breaker picker and doubled 4 into 1. At this picker the cut-waste laps are put in in the proportion of three laps of raw stock to one lap of cut waste, the waste lap being generally inserted between the back and third lap. The speed of this beater is 1,400 revolutions per minute; the two-bladed beater, 925 revolutions per minute; and 1,050 revolutions per minute for a pin beater. The total weight of the lap at the front is 39 pounds or a 16-ounce lap for a 40-yard (in length) lap. The laps are next put up at the card. This card should have a licker-in speed

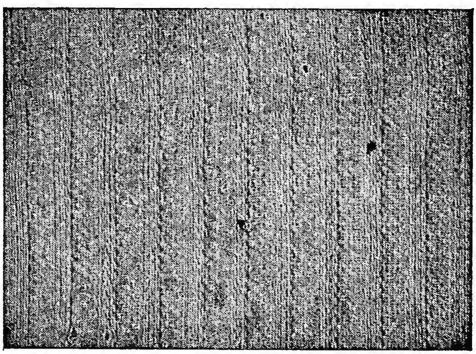


Fig. 8.

of 350 revolutions per minute. The wire used should be 110s for cylinder and 120s for doffer and top flats. The top flats should make one complete revolution every 45 minutes and should be looked after to see that they are properly cleaned and ground. Grind and strip and set as per instructions given in a previous article on the same length of staple. The weight of the sliver at the front should be 45 grains per yard and the production 650 pounds per week of 60 hours. The cottons are next put through the sliver lap machine, the doublings being 14 into 1 and the weight per yard of lap being 290 grains per yard. These laps are put up at the ribbon lap machine and doubled 6 into 1, the weight per yard of lap being 275 grains.

AT THE COMBER

the laps are doubled 6 into 1 and the weight per yard of the sliver is 40 grains per yard. For this class of goods 16 per cent of waste is taken out. Keep the leather top rolls in good condition and well varnished and the comber free from dirt. At the drawing frames the doublings at the breaker are 8 into 1 and at the finisher 6 into 1. This is not the case in all mills, as the number of doublings used varies. The weight per yard at the finisher drawing is 70 grains. This is put through the slubber and made into .60 hank roving. The slubber roving for the 30s and 35s yarn is made into 2 hank roving at the intermediate fly frame and 6.50 at the fine frame. The hank roving for the 48s is 2.50 at the intermediate and 9.50 at the fine frame.

THE SIZING

of the cotton should be as follows: At pickers, every lap and a variation of not more than one-half a pound from standard weight allowed; at the card once a week; at sliver and ribbon lap once a day; at drawing frame four times a day; at slubber once a week, at intermediate once a week, and at fine frame once a day.

The roving for 30s selvage yarn is made on a frame having a 6½-inch traverse, 1¾-inch diameter of ring, 26.02 twist per inch and a spindle speed of 9,800 revolutions per minute; for the 35s the same conditions exist except that a 1⅝-inch diameter ring is used, a 28.10 twist per inch and a spindle speed of 10,300 revolutions per minute. The yarn is then spooled and warped and put through a slasher. The filling yarn may be either mule or ring spun; if the latter, use a frame having a 1¼-inch diameter ring, 5½-inch traverse, 25.98 twist per inch and a spindle speed of 8,400 revolutions per minute. This yarn is then conditioned, after which it is ready for the loom.

Dyeing Particulars.

BRONZE.

Five per cent pyrol bronze; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

GREEN.

Six per cent pyrol green G.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BLUE.

Six per cent pyrol blue B.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

OLIVE.

Two per cent immedial indone B.; 6 per cent immedial yellow D.; ½ per cent immedial catechine G.; 9 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt.

WINE.

Eight per cent diamine Bordeaux B.; 2 per cent sal soda; 25 per cent salt.

RED.

Five per cent diamine fast red BB.; 2 per cent sal soda; 25 per cent salt.

NAVY BLUE.

Eight per cent katigen indigo B.; 8 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

SLATE.

One per cent thion black TB.; 2 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

SKY BLUE.

One per cent diamine sky blue FF.; 1 per cent sal soda; 10 per cent salt.

SEA GREEN.

One-half per cent immedial green B.; 1 per cent sodium sulphide; 2 per cent soda ash; 10 per cent salt.

UNION LINEN LAWNS

These fabrics, as the name implies, are made up of cotton and linen yarns. The cotton in most cases forms the warp and the linen is woven in as filling.

Union linen lawns are plain woven fabrics made in various textures in regard to ends and picks per inch, and also the quality and counts of yarn.

The goods are used or various purposes, principal among which are furniture coverings, summer outing suits and dusters. The goods, when used for the above purposes, are usually finished without bleaching. The cotton yarn is usually dyed to match the color of the unfinished linen warp or filling, as the case may be.

The fabric as used for household purposes is usually finished white or bleached.

CLASSIFICATION AND ORIGIN.

Woven fabrics may be divided into three classes, generally speaking, and from these there are derived all the various weaves now in use, with the possible exception of the leno weave, which may be placed in a class separate from the three foundation weaves, to wit, the plain weave or cotton weave, second, the twill weave, and third, the satin weave. The first named in the division covers a greater variety of fabrics than the combined number of the latter two, the weave in connection with the kind and quality of yarn and also the texture. Notwithstanding that there may be several textures in any particular fabric, these are the distinguishing features that characterize the wide range of cotton fabrics.

The origin of tbe name is derived sometimes from the city or country in which the fabric was first made, or from the name of the maker; or, again, it may be given to the fabric from the nature of the material of which it is made, as, for example, union linen lawns; the name lawn implies that the fabric is plain woven. In

THE CONSTRUCTION

of these fabrics there is considerable latitude in regard to ends and picks per inch and counts of yarn. Some grades of linen lawns are made up very firmly, again others may be constructed rather loosely.

ANALYSIS.

Width of warp in reed, 38 inches; width of fabric, finished, 36 inches; ends per inch, finished, 60; ends in warp, 2,160; ends in selvages, 20; total, 2,180.

Reed, 27½ x 2; take-up of warp during weaving about 8 per cent; warp, 1-40s cotton.

Filling, 1-20s linen, 300 yards per hank; 56 picks.

Analysis of a coarser grade of union linen lawn: width of warp in reed, 37½ inches; width of fabric, finished, 36 inches; ends per inch, finished, 52; ends in warp, 1,872; ends in selvages, 16; total, 1,888.

Reed, 25 x 2; warp, 1-30s cotton.

Filling, 80s linen, 300 yards per hank; 50 picks per inch; take-up during weaving, 10 per cent.

Fig. 1 weave.

Fig. 2 drawing-in draft.

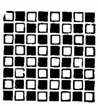


Fig. 1.

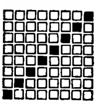


Fig. 2.

WEAVING AND FINISHING.

Fabrics used for dress goods, that is, outer garments, require more attention in the weaving than almost any other class of fabrics. The goods should be woven faultlessly, or, if the fabric has any faults, these must be mended so as not to show in the finished fabric; otherwise the goods can

only be sold as seconds and at a greatly reduced price; consequently, a weaver has charge of but four looms on plain woven fabrics, intended for dress material. The looms used for these goods may be plain cam or roller looms, running at from 140 to 160 picks per minute. The goods, after they come from the loom, are burled and mended, then boiled off if finished without bleaching, or they may be bleached, then pressed, made up into laps and are then ready for shipment.

Carding and Spinning Particulars.

Union linen lawn is composed of two fibres, linen and cotton, the warp yarn being cotton and the filling yarn linen. Several grades of this fabric are made, two of which are taken for example. In these two the warp yarn is 1-40s for the fine and 1-30s for the coarser fabric. These yarns are made in the same division of mills and, in fact, the same mills make the two classes of fabric. Where this is the case,

THE DIFFERENT PROCESSES,

weights per yard, etc., are the same up to a certain point. We will consider the two counts to be made of the same staple and grade of cotton, which would be 1⅛-inch staple peeler cotton. The bales should be opened, stapled and graded before being put into the mixing, which may be done either by hand or by machine, that done by the bale breaker being better, because it opens the cotton more thoroughly. The good sliver from the machines up to the slubber is mixed in at this point either as it is collected, or as is often done, on mixing days. The cotton is put through three processes of picking and an opener.

AT THE OPENER

the general instructions given in previous articles should be followed. At the breaker picker the type of beater used may be either a pin or three-bladed, rigid type. The speed of the pin beater is 1,200 revolutions per minute and of the three-bladed type 1,000 revolutions per minute. The weight of the lap at the front of this machine is 40 pounds or a 16-ounce lap. At the intermediate picker the speed of a three-bladed beater is 975 revolutions per minute, the doublings being 4 into 1. The total weight of lap at the front of this machine is 37½ pounds or 15 ounces per yard. At the finisher picker the doubling is 5 into 1. The speed of a two-bladed, rigid type of beater is 1,425 revolutions per minute. The total weight of a 40-yard lap is 33 pounds or a 13-ounce lap. At this machine the cut-roving waste laps are mixed in the proportion of three laps of good cotton to one lap of cut waste. It is

GENERALLY THE CUSTOM

to prepare these laps at the intermediate picker. At the card the draft should not exceed 100 and the speed of the licker-in is 350 revolutions per minute. The wire fillet used should be that used for medium counts of yarn, or No. 110s or cylinders and No. 120s for doffer and top flats. The speed of the top flats (110 to set) should be one complete revolution every 50 minutes. The weight of the end sliver at the front should be 45 grains per yard and the production 650 pounds per week of 60 hours. Strip cards three times a day and grind once every three weeks. After grinding, set all important parts. Clean out fly at regular intervals for this class of work, it being done twice a day. Watch the strips from the top flats to see how they are working. Always have plenty of

SPARE BANDS

on hand so that if one breaks another may be put on without loss of time. Always see that the brackets used for the stripping brush are properly set for both doffer and cylinder and also see that they are properly stripped by the card attendants, for too often they are only half stripped if they are not watched. The yarn used for this class of goods is combed, and at the sliver lap the weight per yard is 290 grains, the doublings being 14 into 1. At the ribbon lap the doublings are 6 into 1, and the weight of a yard of lap is 270 grains per yard.

At the comber the doublings are 6 into 1 and 16 per cent of

waste is taken out. The weight of the sliver at the coiler is 50 grains per yard. Follow the particulars for setting, timing and varnishing the rolls as given in a previous article. The doublings at the breaker are 8 into 1, two processes of drawing being used. The weight per yard at the breaker drawing is 90 grains per yard. At the finisher drawing the doubling is 6 into 1 and the weight per yard is 70 grains. At the slubber the drawing sliver is made into .60 hank roving. The yarn is next put through two processes of speeders or fly frames. At the first intermediate the hank roving is 2 and at the second or finishing speeder the hank roving is 6 for 30s yarn, and 8 hank for 40s yarn. The roving is next taken to

THE SPINNING ROOM

and spun into 30s on a frame having a 6½-inch traverse, 1¾-inch diameter ring, 26.02 twist per inch and a spindle speed of 9,800 revolutions per minute. For spinning 40s, a frame with a spindle speed of 10,000 revolutions per minute, 28.46 twist per inch, 1⅜-inch diameter ring and 6½-inch traverse, is used. After being spun, the yarn is spooled and then run on a beam. Several of these beams are put up at the back of the slasher and after being slashed are run on a beam at the front.

Dyeing Particulars.

OLIVE.

Five per cent pyrol olive G.; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BRONZE.

Five per cent pyrol bronze G.; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BLACK.

Ten per cent thiogene black M. conc.; 10 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt.

SLATE.

One per cent thion black TBC.; 1 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

ECRU.

Three-quarters per cent thion brown G.; 1 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

RED.

Six per cent diamine fast red BB.; 2 per cent sal soda; 25 per cent Glauber's.

BROWN.

Five per cent immedial brown B.; 5 per cent immedial cutch O.; 10 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt.

SKY BLUE.

One and one-half per cent thion blue B. conc.; 1½ per cent sulphide sodium; 1 per cent soda ash; 20 per cent salt. Develop with peroxide of hydrogen.

NAVY BLUE.

Eight per cent thion navy blue R.; 8 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt. Develop with peroxide of sodium.

SATIN CHECKS

Satin checks, so called, derive their name from the appearance of the pattern, which consists of variable block effects, usually equal in size in the same piece, on the plain weave basis.

Some of the larger effects resemble checkerboards and are known as such. They are also known as dice checks.

A satin check fabric made in England for the northwestern Africa export trade is similar in construction and finish to the "herringbone" fabric, considered in a preceding article, and the data given there in connection with these items will also apply here.

The weave principle upon which the cloth has been constructed may be seen in Fig. 1, which is composed of warp flush and filling flush weaves arranged on the plain cloth base, four square sections completing the weave. In this case the complete weave is on 48 x 48, each section being on 24 x 24. The base weaves used are the $\frac{1}{5}$ and the $\frac{5}{1}$ twills.

The object in alternating blocks of warp flush weaves with blocks of fill-

ing flush weaves is to produce a cloth whereon the pattern seems to appear stronger when viewed in certain directions than when viewed in others, with two weaves that have the same structure, although differing in appearance. This principle is developed on an extended scale in white damask tablecloths.

The shadow effect seen in these

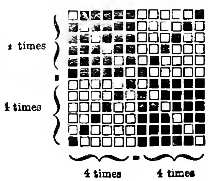


Fig. 1.

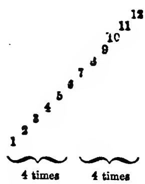


Fig. 2.

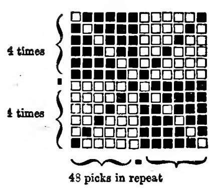


Fig. 3.

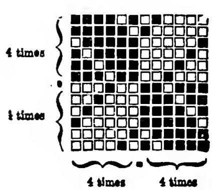


Fig. 4.

goods is an optical illusion, due to the reflection of the light after it falls on the filling, being at a different angle to that reflected from the warp, both being viewed from the same position. The larger the section and the greater the proportion of one yarn as compared to the other in the same, the more lustrous will be the general appearance of the goods.

Fig. 2 shows the harness draft and Fig. 3 the chain draft for producing the weave. Fig. 2 is known as a sectional drawing-in draft.

One of the principal points to be noted in the construction of these weaves is to make the warp floats of each section oppose the filling floats of the adjoining sections, both warp and filling way If this is not done, a ragged or indistinct pattern will result, in addition to the cloth not having as firm a feel.

Another point is that it is advisable to arrange the base weaves in such positions that although there are four sections in each repeat of the weave, the two filling flush sections will be exactly alike and the two warp sections alike, whenever possible.

This may perhaps be better understood by reference to Figs. 1 and 4. Fig. 4, although composed of the same base weaves as Fig. 1, would not make as clean and even an appearance in the cloth as the latter

A satin check made with Fig. 5 would be preferable to one made with Fig. 6, other conditions being equal. Both of these weaves are built up from broken crow weave bases and cut on all sides.

Weave Fig. 7 would be preferable to weave Fig. 8. Both are made from the same 8-end satin weave bases, started in different relative positions.

LOOM REQUIRED.

Being woven white and with one count of filling only a single box dobby loom is generally used when weaving these goods. The two base weaves, one warp flush and the other filling flush, are seldom made on more than 8 ends and 8 picks each, therefore a 16-harness dobby, with a selvage motion extra, is large enough to allow ample scope for producing a variety of patterns. An 18 or 20 harness dobby should be used if there is no selvage motion on the loom.

Carding and Spinning Particulars.

As the fabric considered is similar in construction and finish to that described under "Herringbone Stripes," the carding and spinning data need not be repeated.

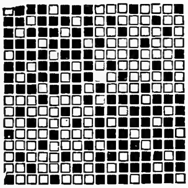


Fig. 5.

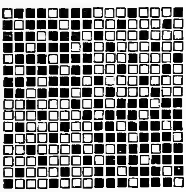


Fig. 6.

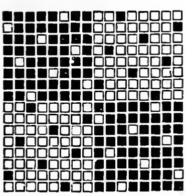


Fig. 7.

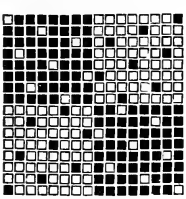


Fig. 8

Dyeing Particulars.

BRONZE.

Five per cent pyrol bronze; 5 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

GREEN.

Six per cent pyrol green G.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

BLUE.

Six per cent pyrol blue B.; 6 per cent sulphide sodium; 2 per cent soda ash; 20 per cent salt.

OLIVE.

Two per cent immedial indone B.; 6 per cent immedial yellow D.; ½ per cent immedial catechine G.; 9 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt.

WINE.

Eight per cent diamine Bordeaux B.; 2 per cent sal soda; 25 per cent salt.

RED.

Five per cent diamine fast red BB.; 2 per cent sal soda; 25 per cent salt.

NAVY BLUE.

Eight per cent katigen indigo B.; 8 per cent sulphide sodium; 2 per cent soda ash; 30 per cent salt.

SLATE.

One per cent thion black TB.; 2 per cent sulphide sodium; 1 per cent soda ash; 10 per cent salt.

SKY BLUE.

One per cent diamine sky blue FF.; 1 per cent sal soda; 10 per cent salt.

SEA GREEN.

One-half per cent immedial green B.; 1 per cent sodium sulphide; 2 per cent soda ash; 10 per cent salt.

NANKEEN, or NANKIN

Nankeen, or nankin, pronounced nan-kēn, is a name given to a class of fabrics woven with the plain weave, the distinguishing effect of which is their peculiar yellowish brown color. This color is natural to the cotton of which they are made, the religiosum variety of the gossypium herbaceum class.

The goods are worn by Chinese people in all parts of the world.

The original nankeen fabric derived its name from Nanking, the ancient Chinese city, now known as the "southern capital," being first constructed there from a native cotton. The pure nankeen fabric is finished and woven in the natural

color and is of Chinese manufacture. The raw cotton is rough, short and hard to work, so much so that the supply of cotton of this type and color grown is not enough to supply the demand for the woven goods. For the last half century or more large quantities of so-called nankeen fabrics of British manufacture have been, and are being to-day, exported to China, the principal market for the same being at Canton. These goods are woven white and subsequently dyed the required color, dyers being able to imitate the qualities of the original nankeen color in all respects.

KINO,

pronounced ke-no, was one of the drugs formerly used for giving nankeen color. Its chief component part is tannic acid.

Nankeen fabrics, deriving their name more particularly from their peculiar color, are made to vary to some extent in counts of yarns and constructions of cloth, although being kept to medium counts and weights.

A characteristic fabric is made as follows: Counts of warp, 26s; counts of filling, 22s; ends per inch, 68; picks per inch, 64; width, 27 inches finished.

At the present time nankeen fabrics are not necessarily those made exclusively of cotton. A sample under consideration is made from silk scrapings or waste and cotton warp, mixed before going through the preparing machines, and silk waste filling. The mixed fibres in the warp appear later in the same yarn, the yarn being single spun. The fabric is very uneven, more so in the filling than in the warp, but quite uneven in both.

LOOM REQUIRED.

Like other plain cloths, a light, quick running plain cam loom is used for their production. Woven a solid color, one warp and one shuttle only are required. The ends are reeded two in a dent throughout.

FINISHING.

Very little finishing is required for the pure goods. After being burled and brushed they are sheared or singed, or both, crabbed, washed, dried and made up as required.

Imitation nankeens, in addition to the above, are subjected to the process of dyeing.

Carding and Spinning Particulars.

For carding and spinning particulars see article on "Tartan Plaids," the counts of yarns for nankeen being similar to those explained in said article.

Dyeing Particulars.

This class of goods is dyed on the gigger dyeing machine in the open width. The method of dyeing is to take the thoroughly boiled and wet out goods and roll smoothly on the first roll of the gigger. Sew the leaders on with smooth, flat seams, then fill the machine with water about six inches above the inside rolls; heat to the required temperature and add ¼ to ½ of the dissolved dye (for light shades it is best to add the color in four portions; for medium or dark shades, the dye may be added in two portions). Then start the machine and pass the cloth through the liquor onto the opposite roll, add more of the dye and return; repeat until shade desired is produced.

A fine nankeen shade may be dyed with the following dyes:

No. 1. Dye with 3 per cent extract fustic; 3 per cent alum. Boil together and add to dye-bath in four portions, dyeing at 120 degrees F.

No. 2. Dye with 1-10 per cent diam fast yellow B.; 0.08 per cent diam catechine G.; 0.015 per cent diam catechine B.; 1 per cent soda; 2 per cent soap. Start dyeing at 100 degrees F., heating slowly to 180 degrees F., then add 5 per cent Glauber's salts in two portions and run to shade.

No. 3. Dye with 2 per cent immedial orange C.; 1 per cent katigen brown GG.; 3 per cent sodium sulphide; 2 per cent Turkey red oil. Start dyeing at 100 degrees F., heat to 180 degrees F. slowly, and run to shade.

MUSLIN—Foundation Muslin

Foundation muslin is a fabric used to impart stiffness to parts of garments, principally light-weight dresses of lawn or goods of similar character used for graduation and other purposes. It is loosely woven and of very light weight. The requisite body is imparted to it in the finishing process by one or more stiffening ingredients.

The cloth is woven plain. The ends are drawn single through the heddles and reeded two in each dent, with the possible exception of the selvage ends.

The analysis of a characteristic foundation muslin shows the following data: Ends per inch, 72; picks per inch, 68; counts of warp, 110; counts of filling, 120; finished width, 31½ inches; weight, 20 yards per pound. The selvages consist of 12 ends of 60s yarn on each side, reeded 3 ends per dent. The counts of yarns here stated are as found in the finished cloth. All the yarns are somewhat hard twisted and are free from loose fibres.

CALCULATIONS.

31½ inches times 36 equals 1,134 dents occupied by the warp; 1,134 minus 8 for selvages equals 1,126 dents; 1,126 times 2 equals 2,252 ends of 110s warp; 8 times 3 equals 24 ends of 60s warp; 2,276, total ends.

To find weight of warp in 100 yards of cloth, assuming 10 per cent contraction in length from warp to cloth of the fine yarn and 5 per cent contraction of the coarse yarn:

$$\frac{2{,}252 \times 110 \text{ (length)}}{110 \text{ (counts)} \times 840} = 2.681 \text{ lbs. of 110s warp.}$$

$$\frac{24 \times 105}{60 \times 840} = .05 \text{ pound of 60s warp.}$$

2.681 pounds 110s.
.05 pound 60s.

2.731 pounds, total weight of warp.

The 60s warp has been considered as having been run from spools, separate from the main warp.

To find weight of filling in 100 yards of cloth:

72 (sley) — 1 = 71.
71 ÷ 2.1 (constant) = 33.82 dents per inch in reed.
1,134 ÷ 33.82 = 33.53 in., width in reed.

$$\frac{68 \text{(pks)} \times 33.53 \times 100 \text{ (length)}}{120 \text{ (counts)} \times 840} = 2.261 \text{ lbs. filling.}$$

In the preceding calculation the gray and finished widths of the cloth have been assumed to be equal, the cloth having been stretched but little, and tentered to the full width, in the process of finishing. The finished width of most fabrics is less than the loom or gray cloth width, requiring that the difference between them be taken into consideration when ascertaining the amount of filling required.

To find number of yards per pound:

2.731 pounds warp.
2.261 pounds filling.

4.992 pounds, total weight.
100 ÷ 4.992 = say, 20 yards per pound.

LOOM REQUIRED.

A light, fast running, single box cam loom is preferable for these goods, the ends being drawn through twine harnesses on account of the large number of ends and picks per inch and fine yarn. Being a very light, sheer fabric, considerable care has to be taken with it in weaving to prevent misweaves of all kinds, particularly thick and thin places, and broken ends and picks.

FINISHING.

This process is really the one which makes the characteristic qualities of foundation muslin as distinct from other plain woven goods. A fabric of the construction mentioned, being similar in all respects except in the finish, would not be known by the same name if finished differently. In fact, many of the cotton fabrics derive their name from the finishing process to which they have been subjected, irrespective of the construction of the cloths. The purpose for which it is to be used determines, to a more or less degree, the construction and quality of plain woven cloths.

Foundation muslins are usually woven in natural color, after which they are bleached and finished white, somewhat as follows: Burl, singe, bleach, size with gum or gum "tragasol," condition, calender and make up.

When required in colors, the goods are dyed in the piece.

Dyeing Particulars.

BLACK.

Eight per cent union black S.; 1 per cent diamine fast yellow A.; 30 per cent Glauber's; 2 per cent sal soda; 2 per cent soap. Top with alizarine black 4 B.

SEA GREEN.

One-half per cent diamine black HW.; 4 ounces diamine fast yellow B.; topped with new methylene blue N.; new phosphine G.

For 10 gallons dye-liquor: 6 ounces soap; ½ ounce sal soda; 3 ounces phosphate soda.

NAVY BLUE.

Three per cent diamine dark blue B.; 1 per cent diamine brilliant blue G.; topped with new methylene blue NX.; metaphenylene blue B.; indigo blue N.

PEARL.

Two ounces diamine gray G.; 1-16 ounce diamine brown M.; topped with aniline gray B.

SLATE.

Ten ounces diamine gray G.; ⅛ ounce diamine brown M.; topped with cyanol extra; orange extra.

LIGHT MAUVE.

One ounce diamine violet N.; ½ ounce diamine brilliant blue G.; topped with methyl violet BI.

VIOLET.

One per cent diamine violet N.; ½ per cent diamine brilliant blue G.; topped with methyl violet BI.

PINK.

Two per cent diamine rose BD.; topped with rhodamine G.

SKY BLUE.

Four ounces diamine sky blue FF.; topped with cyanol extra.

LIGHT BROWN.

One per cent diamine brown B.; ½ per cent diamine yellow B.; topped with Bismarck brown FF.; thioflavine T.

MYRTLE GREEN.

Two per cent diamine black HW.; 2 per cent diamine green B.; 1 per cent diamine fast yellow B.; topped with brilliant green; new methylene blue N.

CREAM.

One-quarter ounce diamine gold; ¼ ounce diamine orange B.; 1-16 ounce diamine fast yellow B.

STEEL.

One-eighth ounce diamine gray G.; topped with cyanol extra; aniline gray B.

SILENCE CLOTH—Filling Backed

Silence cloth, or table felting, is a heavy cotton fabric used to cover the table, under the linen cloth, for the purpose of preventing damage to the finish of the table and to make the cloth look whiter.

Standard widths of these goods are 54 and 64 inches.

In order to make heavy, thick, firm fabrics it becomes necessary to depart from single cloth structures and interlace the yarns on one or other of the compound weave principles, such as backed, double or heavier ply cloths. In these fabrics some of the yarns, while forming part of the structure, may appear only in the center or the back, not showing on the face.

THE SIMPLEST FORM

of these is either a warp-backed or filling-backed fabric, the former of which was shown in the article on "Cotton Cassimeres."

Filling-backed fabrics, especially those of the reversible type, i. e., those

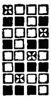


Fig. 1.

with the face and back similar, that are made with filling flush weaves, are excellently adapted for making silence cloths, because a heavy nap is required

on both sides of the fabric and this can be obtained best by using soft yarn. The nap is obtained principally with the filling yarns, which are soft and coarse, as warp yarn must have considerably more twist than is required for filling in order that it may withstand the wear and tear of the movements caused by the heddles and reed during weaving.

Fig. 1 shows a weave for a filling-backed fabric with a $\frac{1}{\quad 3}$ twill on each side. Marks ▪ represent the face weave; solid type represents the back weave.

A cloth woven with this design would show the warp on both sides, when in the gray, but only one-half of the filling on each side.

The individualities of the yarns are lost in the finishing process; in silence cloths, therefore, such a cloth, if woven with Fig. 1, picked one pick white and one pick color, would have a white surface on one side and a colored one on the other. As the loose fibres of the filling would practically cover the warp, the color of the latter would be of little consequence. On the score of economy it would be best to have it white.

THE ANALYSIS

of a silence cloth, before finishing, shows it to have been constructed as follows: Ends per inch, 68; picks per inch, 40 (20 on the face and 20 on the back); warp counts, 11.6, probably intended for 11.5; filling counts, 2⅞; width, 58 inches; weight, 1.45 pounds per yard; weave, Fig. 1. This cloth would finish 54 inches.

The warp has contracted 18 per cent in length. The filling lies straight, showing little, if any, shrinkage from loom to cloth. It is soft twisted, containing but five turns per inch.

Very heavy silence cloths are constructed on the double or higher ply cloth principles.

LOOM REQUIRED.

For weaving filling-backed silence cloths a heavy loom is required. Although they may be woven on cam looms, a dobby would be preferable, unless it was certain that the same pattern would be run on the loom continually. One warp and one shuttle only are required. On account of the coarse filling and the width of the cloth, the shuttles should be large.

FINISHING.

The processes of bleaching and napping constitute practically all the finishing these goods receive, being woven and finished white.

Carding and Spinning Particulars.

Silence cloth is made up of yarns which are made in the first division of mills, as given in a previous article. The counts of yarn vary according to the weight of the cloth and in the sample that has been taken for description are as follows: 11½s for filling and 2.75s for warp. These yarns are soft twisted to allow them to be easily brushed, so as to cause a short soft nap. The yarns are made of short stock, but as a general rule, waste (except cut-roving waste) does not enter into the mixing. The staple used would be about ¾ to ⅞ inch in length. The mixing should be large and at each mixing the cut-roving waste laps should be mixed in. Mixing for this class of goods is done by hand, and it is the general rule to work for production and not for quality, as a great many defects are covered up in the brushing of the cloth.

TWO PROCESSES OF PICKING

are used. The mixing after being allowed to stand is fed to the feeders. The seeds, fly, etc., should be taken out at regular intervals and care taken to see that the pin beater is properly set so that the correct amount of cotton will be fed to the breaker picker, to which the opener is generally attached. The beater of this picker is generally of a two-bladed, rigid type, and for this stock its speed is 1,550 revolutions per minute. The total weight of the lap at the front should be about 40 pounds or a 16½-ounce lap. At the finisher picker the doubling is four into one, the speed of the beater, 1,500 revolutions per minute, and the total weight of the lap 39 pounds, or a 14½-ounce lap. A variation of not over 8 ounces either side

of standard total weight should be allowed. Care should be taken to see that the drafts are properly directed, so as to make an even lap that does not have a tendency to split or lick up. The eveners should be properly looked after to see that they are working properly and the dirt, seed, etc., cleaned from under and about the machines at regular intervals. If possible the pickers should be run so that they may be stopped as early as possible in the week, so as to clean out the cages, feed rolls, etc.

AT THE CARDS

the draft should not exceed 95, and the wire fillet used on the cylinder should be No. 90s and on the doffer and top flats No. 100s. Grind and clean cards as given in previous articles. The settings of the different parts of the cards should be the same as those given for indigo prints in a previous article. The weight of the sliver should be 65 grains per yard, and the production from 800 to 1,000 pounds per week of 60 hours. For this class of goods two processes of drawing frames are used. The frames may be fitted with either leather covered or metallic top rolls; generally speaking, the former are preferred for various reasons. The doublings are 8 into 1, and the weight of the sliver at the finisher drawing frame is 75 grains per yard. The speed of the front roll is 400 revolutions per minute.

At the slubber the sliver is made into .40 hank. For

THE WARP YARN

this is spun into 2.75 (single) soft twist. For the filling yarn there is one process of fly frame at which the slubber roving is made into 1.25 hank. The setting of the rolls should be looked after to see that they are properly spread and that the top rolls are in good condition. The speeder or fly frames should be scoured at least once a year. After passing the fly frame the roving is made into 11.5s, being put in single, on a frame having a 7-inch traverse, 1$\frac{5}{8}$-inch diameter ring and spindle speed of 6,500 revolutions per minute. This yarn is also soft spun.

ORLEANS LININGS

Orleans linings refer to a class of goods, of various qualities and patterns, having a cotton warp and worsted filling. They are used principally for lining the heavier garments for outer and winter wear, and are seen in black and all the fashionable shades. A large proportion are made with the 5-end twill, $\frac{1}{4}$, ground, Fig. 1, the selvage being woven plain, or with two picks in a shed and catch

Fig. 1.

thread on the outside.

The cheapest grades are woven white, then piece-dyed in solid colors. Better grades have warp dyed yarns, the filling in the same being woven white and dyed to match the warp after it leaves the loom. By this method cotton warp yarns of two colors may be used, say black and white, the black being used for the body of the cloth and the white for the selvages, the dyes used for the wool not affecting the cotton to any appreciable extent.

Advertising has educated the retail

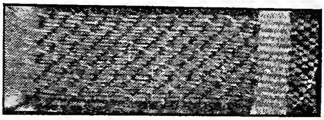


Fig. 2.

dealers and consumers to the fact that cotton warp goods with a white selvage, the ground being of color, are more to be depended upon not to crock than similar cloths of solid color.

The worsted filling used is of a naturally lustrous type, which is capable of being made more lustrous by the finishing process. The yarns are required to be of good quality in order

to finish and make up satisfactorily. Fig. 2 illustrates a characteristic Orleans lining, unfinished, containing three counts, colors and qualities of warp yarns. The ground warp is of a dark slate color (probably intended for black). This is of 30s counts, is reeded 3 ends per dent, and weaves as shown in Fig. 1. The section just inside the selvage is solid white, is of 3-ply 100s counts, is reeded 8 ends per dent, and weaves two picks in a shed; there are 24 white ends on each side. The selvages proper consist of 16 ends of 3-ply 60s black cotton on each side and are reeded 4 ends per dent; they weave plain. The selvage ends are drawn 2 as 1 through each heddle; the remainder of the ends are drawn single.

CONSTRUCTION.

The construction of the cloth is 80 square, i. e., 80 ends and 80 picks per inch.

The fabric under consideration, Fig. 2, would require 9 harnesses, 5 for the ground, 2 for the white warp and 2 for the selvages, and could be handled best on a dobby loom. By exceptional care in beaming the yarn it would be possible to put the three counts of warp on the same beam, but it is not advisable to do so for various reasons. One is that the 3-100s yarn, being so crowded in the reed, would under normal conditions take up faster than the ground warp and thereby become tighter. Being 3-ply yarn of good quality it might stand the strain of weaving all right, but would not stretch to any extent in finishing. If the ground cloth was stretched to its limit in finishing, the white yarn would be liable to break during that process. For the best results it would be advisable to run the white and selvage yarns from spools, and the ground warp from the main beam. The white yarn should be run with a minimum amount of tension.

The white ends in this sample are so crowded in the reed as to cover the filling entirely; these would show solid white even after the filling was dyed to match the ground warp. It is something out of the ordinary to have such an elaborate selvage as this on a lining fabric, the general run of the goods having a solid color ground and a few white ends for selvage.

LOOM REQUIRED.

For ordinary lining fabrics where the ground weave does not occupy more than 5 harnesses, a cam loom with a selvage motion would be the best to use. A loom weaving 5 ends sateen could readily be changed over to weave a 5-end twill by changing the order of treading the cams, or, if the cams are cast in one piece, by changing the order of tying up the harnesses. One shuttle only is required.

FINISHING.

The finishing process consists of burling, singeing, crabbing, dyeing, drying and shearing and pressing on hydraulic press.

Carding and Spinning Particulars.

Orleans linings are made up of worsted and cotton yarns. The counts of these vary according to the grade of the lining desired. The cotton warp yarns of the sample analyzed are: main warp 30s, section just inside the selvages, 3-100s, and the selvage itself 3-60s. These counts of yarn are made in the third division of mills as given in a previous article. While the count of the main yarn is only what may be called a medium count, still, it is made in mills where fine counts are made. It must be understood that while the mills making fine count yarns may and do make low or coarse count yarns, the medium and low count mills cannot make high count yarns with equal success.

FOR THE YARNS

in the fabric to be described, three different lengths of staple cotton are used. These are mixed either by hand or with the bale breaker, the latter being the better method, because no matter how closely the laborers are watched, they do not break up the cotton as it should be done. The mixing should be allowed to stand as long as possible in order to dry out. Three processes of pickers are used and the same beater speed may be used **for the**

three different lengths of staple. At the breaker picker a two-bladed beater of the rigid type is generally used. The speed of this beater is 1,500 revolutions per minute. Care should be taken to have the feed rolls and cages taken out and cleaned at regular intervals, which should be as frequently as possible. Be careful to get a lap that does not split. The weight of the lap at the breaker picker should be about 40 pounds for all three staples. At

THE INTERMEDIATE PICKER

the laps are doubled 4 into 1. The speed of this beater is 1,450 revolutions per minute. The weight of the lap at the front is 37½ pounds. At the finisher picker the laps are doubled 4 into 1, and the speed of the beater is 1,400 revolutions per minute. The total weight at the front may be the same for all staples or they may have different weights, according to the ideas of the ones in charge. If of different weights, the weight of the lap for the 30s yarn, which would be made out of 1⅛ to 1 3-16 inch staple cotton would be 39 pounds or a 14½-ounce lap; for the 60s yarn (1 3-16 to 1 5-16 inch staple), 35 pounds or a 12½-ounce lap; and for the 100s yarn (1½ to 1⅝ inch staple), 35 pounds or a 12½-ounce lap. The staples of cotton given above are for the fabric under description, and do not apply to all fabrics made up of the same counts of yarn. Look out for the drafts and see that the required number of laps are always up at the different processes and also that

THE EVENING MOTIONS

are in perfect working order. A variation of half a pound either side of the standard weight is allowed, but all laps that vary more than this should be run over again through the finisher picker. Look out to see that the picker tender on the finishers does not pull enough lap off of a heavy lap to make it the required weight. Enough laps should be made between Monday and Friday noontime to enable the cards to be run the rest of the week. This is so that the picker men may have time to clean the pickers and make all repairs on the machines that are required.

THE CARDS

should be equipped with fine counts of wire fillet. The draft at the card for the 30s yarn should not exceed 95, for the 60s, 100, and for the 100s not less than 100. The flats for the coarser yarn should make one complete revolution every 55 minutes, for the middle count in 50 minutes, and for the fine count in 40 minutes. Grind, strip and set as described in previous articles when these counts of yarns have been described. The weight per yard of the sliver should be 45 grains and the production 800 pounds for the 1 3-16 inch staple, 700 pounds for 1 5-16 inch staple and 550 pounds for 1⅝-inch staple for a week of 60 hours. All the card sliver for this fabric is combed. It is

THE GENERAL METHOD

to run the cotton in succession through the following machines: sliver lap, ribbon lap and comber, but a great many mill men nowadays prefer the following arrangement; one process drawing frame, sliver lap and comber. If the former method is used, the doubling at the sliver lap machine (for an 8¾-inch width lap) is 14 into 1, and at the ribbon lap machine 6 into 1. The weight of the lap at the sliver lap machine is 295 grains per yard, and at the ribbon lap machine 275 grains per yard for 1 3-16 inch staple, 290 grains at sliver lap and 275 grains at ribbon lap for 1 5-16 inch stock and 280 grains and 265 grains for 1⅝-inch stock. Size at ribbon lap once a day, an allowance of five grains either side of standard weight being allowed before changing draft gear. At the comber the doubling is according to the number of heads that comber contains (6 or 8). The usual setting and timings should be used. The percentage of waste taken out at the comber is as follows: 15 for 1 3-16, 16 for 1 5-16 and 18 to 20 for 1⅝-inch stocks.

TWO PROCESSES OF DRAWING

are used, the doubling at the breaker being 8 into 1, and at the finisher 6 into 1. The weight of the sliver at the

finisher drawing is 70 grains per yard for all the cotton. Size drawings four times a day, an allowance of 2 grains per yard either side of standard weight being allowed, before changing draft. At the slubber the sliver is made into .60 hank roving for all stocks.

To make 30s yarn the cotton is put through two processes of fly frames. At the first intermediate, the hank roving made is 2, and at the fine frame 6. This is made into 30s yarn on a warp spinning frame with a 2¾-inch traverse, 1¾-inch diameter ring, and a 6½-inch bobbin. The yarn is then spooled, warped and put through the slashers.

THE SLUBBER ROVING

for the 60s yarn is put through three processes of fly frames, the hank roving being 1 at first intermediate, 3 at second intermediate and 12 at jack frame. This is spun into 60s yarn on a frame having the following particulars: 1½-inch diameter ring, 6-inch traverse, and spindle speed 10,000 revolutions per minute.

The yarn is then spooled, made into 3-ply yarn, spooled and run onto a selvage warp.

The slubber roving for 100s yarn is also put through three processes of fly frames. At the first intermediate it is made into 2 hank, at the second into 6 hank, and at the fine or jack frame, 20 hank roving. This is spun into 100s on a spinning frame having a 2¾-inch gauge, 1⅝-inch diameter ring, 5-inch traverse and a spindle speed of 9,400.

After being made into 100s yarn it is spooled and twisted into three-ply yarn, after which it is spooled and warped and put through a slasher.

At the sliver lap machine, ribbon lap machine, comber and drawing frame the leather top rolls have to be varnished, and should be kept in perfect condition, both as to varnish and leather.

THE VARNISH USED

for the comber rolls should be of a heavier or rougher kind than that used for the other rolls. Several recipes for varnish have already been given, but the following will also be found an excellent one: For comber rolls use 8 ounces plate glue, 8 ounces ground gelatine, 12 ounces burnt sienna, 1 ounce oil originum, 3 pints acetic acid, 1 pint water. For the other rolls use the same mixture, excepting that vermilion should be used instead of the burnt sienna. This will make a much smoother roll than the varnish used for the combers. Many also varnish the front rolls of the slubber; when this is done the varnish used should be thinner than the others, being thinned with the acetic acid.

Dyeing Particulars.

Dyeing orleans linings, as in all other classes of goods, is done in a good many ways, according to the quality and the price the goods are sold at. A fine quality black orleans is woven with a black warp, which will stand the after processes of finishing and dyeing, which are crabbing, scouring, singeing and steam lustering; then dyeing either with a logwood black on a chrome mordant or one of the blacks which dyes the worsted filling at one dip in an acid bath. If the goods have white cotton threads in the selvages, the dyer will select one of the blacks which have no affinity for cotton in the acid bath. Dyestuffs suitable for the warps on this class of goods are

THE SULPHUR BLACKS,

which are sold under several names, but all dyed in the same manner in a bath composed of the dye, sodium sulphide, soda ash and common salt or Glauber's salts. Another black suitable for this class of goods is the diamine blacks, developed. These blacks are dyed in the following manner: first the warps are dyed in a boiling bath with the diamine black and Glauber's, then treated in a cold bath with nitrite of soda and muriatic acid, then in a third cold bath with phenylenediamine. Fast slate shades are dyed the same as the blacks, only using about half the proportion of dyes and shading with small portions of red or yellow of the same group of dyes. Orleans

FOR FANCY COLORS

are woven with white cotton warps and worsted filling, which are dyed

either with the direct colors, which dye the cotton and worsted at one bath, or the four-bath method. The first method consists in dyeing in a bath composed of the direct cotton and wool dyes which dye in a neutral bath with Glauber's salts at boil. The second method is to first dye the worsted filling with aniline dyes in a bath with acid and Glauber's salts. Wash well. Then treat the warps with tannic acid, or sumac, in a cold bath; then in a third bath, with tarta emetic, or one of the antimony salts; then in a fourth bath dye the warp to shade with basic dyestuff. The dyeing of this class of goods, like that of all other goods dyed in the piece, requires considerable practice and skill.

SHADOW CHECKS

Shadow checks are a class of patterns of set check or block effects of a very faint character. Viewed from certain directions, they appear to have a faint stripe or to be without pattern entirely. They are seen in apparel goods of various materials, from silk to cotton, and usually in plain, simple twill, or other small regular weave. The goods are always shown in white, black or solid color.

Shadow checks are the faintest check effects that appear in woven goods, and are made by arranging a certain number of ends of yarn twisted to the right and a certain number twisted to the left, and picking the filling in a similar manner. For example, a shadow check of the shepherd plaid type, i. e., a check with alternate blocks of equal size, might have the warp yarns arranged 10 ends of right twist and 10 ends of left twist alternately, the filling being inserted 10 picks of right twist and 10 picks of left twist.

A MODIFICATION

of this might be made by arranging the yarns in both warp and filling, 4 right twist, 2 left twist, 4 right, 4 left, 2 right, 4 left; 20 ends and 20 picks per pattern.

As the yarns are all of the same counts, material, quality and color, and are reeded equally, it follows that something out of the ordinary causes the check effect. It is an optical illusion, due to the reflection of the light that falls upon the fabric being deflected at a different angle in the sections composed of right twist yarns to the sections composed of the reverse twist yarns.

In a shadow check of the shepherd plaid type under consideration, the face yarns are arranged 16 of each

Fig. 1.

twist alternately in both warp and filling. The face weave is the 4-end basket.

LOOM REQUIRED.

These goods require box looms of the simplest type, with two boxes at one end and a single box at the other.

The manner of preparing the warps determines to some extent the type of shedding motion to use, whether cam or dobby. As the finished fabrics are required to be in one solid color, and some warp yarns differ from others only in the direction of twist in the same, care has to be exercised to keep the yarns where they belong and to tie in the right twist when an end breaks.

ONE OF TWO METHODS

may be adopted to assist in keeping the yarns in order:

First, tint the yarns of one twist with a light substance that may be noticeable in the loom and yet wash out readily before it is dyed, the other warp yarns being in the gray. By this method the warp yarns may all be readily drawn on one beam, and woven on a cam loom.

Second, place the different twists of yarns on separate beams and draw them through separate sections of harnesses. When this method is adopted it is advisable to use the dobby in preference to cams on account of the number of harnesses required.

Two colors or kinds of bobbins should be used, one for each kind of twist, so that the filling will not be liable to get mixed; or if cops without tubes are used, the shuttles should be marked so as to be easily distinguished. Tubes of different colors can be used if the cops are built on tubes.

IMITATIONS

of shadow checks have been shown to some extent in cotton warp and mohair or luster worsted filling goods. These are made with the warp yarn all the same twist, the shadow effect, warp way, being obtained by reeding some dents with more ends than others.

In a fabric of the type of goods under consideration, the yarns are arranged as follows:

WARP.

Ends.		Dents.
18	in	9
1		1
18		9
1		1
10		5
1		1
10		5
1		1
10		5
4		4
10		5
4		4
10		5
1		1
10		5
1		1
10		5
1		1

Total, 121 ends in 68 dents per pattern.

FILLING.

Right twist yarn.	Left twist yarn.
10	
	6
10	
	6
6	
	6
6	
	6
6	
	10
6	
	10
6	
	6
6	
	6
6	
	6
62 +	62 = 124 picks per pattern.

As these fabrics are characterized by the pattern, the constructions of the cloths vary considerably. The fabric under consideration contains an average of about 55 1-3 ends per inch of 2-120s cotton, the same twist throughout. Each pattern contains 121 ends and measures 2 3-16 inches; 121 divided by 2 3-16 equals 55 11-35 or 55 1-3 per inch.

There are 48 picks of worsted per inch.

Shadow stripes are made by using only one kind of filling, the warp yarns being arranged as in shadow checks, with the take-up of the cloth regular. An irregular take-up would make a check effect.

Carding and Spinning Particulars.

The carding and spinning data for this class of fabric are those given in the article on batiste and need not be repeated here.

Dyeing Particulars.

These goods are dyed with 30 per cent Glauber's salt and run at a temperature of 190 degrees F. until the wool is dark enough, when the steam is turned off, the bath cooled down and the goods run until the cotton warp is dyed to shade.

LIGHT PINK.

One-half to 2 ounces Erika pink.

BLACK.

Five per cent union black SB.

LIGHT BLUE.

Dye as pink, with ½ to 1 ounce tetrazo brilliant blue 6 B.

LIGHT SLATE.

Two ounces diamine black BH.; dye as pink.

RED.

One-half pound benzo fast red 4 B.; dye as pink.

YELLOW.

Dye as pink. Eight ounces chrysophenine.

ORANGE.

Dye as pink. One pound Mikado orange B.

SCARLET.

Dye as pink. One pound diamine scarlet B.

LIGHT WINE.

Dye as pink. One pound diamine Bordeaux B.

LIGHT AMBER BROWN.

Four ounces diamine catechine G.; 4 ounces diamine fast yellow B.; dye as pink.

TOBACCO BROWN.

One-half pound diamine brown B.; 2 ounces diamine fast yellow B.; dye as pink.

LIGHT TAN.

Dye as pink; 4 ounces diamine bronze G.; 2 ounces diamine fast yellow B.

LIGHT GREEN.

Dye as pink; 10 ounces diamine green G.; 5 ounces diamine fast yellow B. Top with fresh bath; 6 ounces brilliant green G.

BARATHEA

Barathea, or barrathea, is a name used to denote a certain effect in woven fabrics, obtained principally by the manner in which the warp yarns are interlaced.

The effect combines to a greater or less degree several well-known types of woven effects. Viewed in certain ways the effect is that of a stripe. Upon close examination it appears like a broken cord, and yet somewhat like a basket weave.

On examination of Fig. 2, the weave will reveal how these effects are obtained. This weave is complete on 24 ends and four picks, having been repeated in the picks. At the points indicated by the space there is a break in the regular formation of the pattern, caused by one section, which is in all respects like the other, in so far as the effect it makes is concerned, being raised half way of one cord above the other, or, as it is termed, one section is "set across" the other. It is at these points that a cut effect is obtained, which defines the stripe warp way. One repeat of the weave, in the number of picks it contains, is represented in the cloth by two repeats of the effect, or two cords warp way.

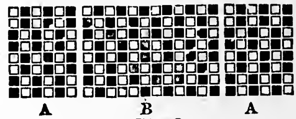
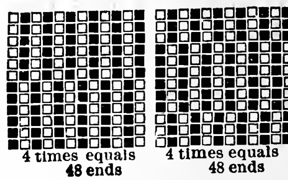


Fig. 2

Fig. 3.



ig. 4.

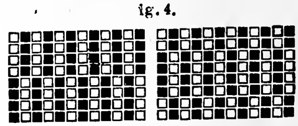


Fig. 5.

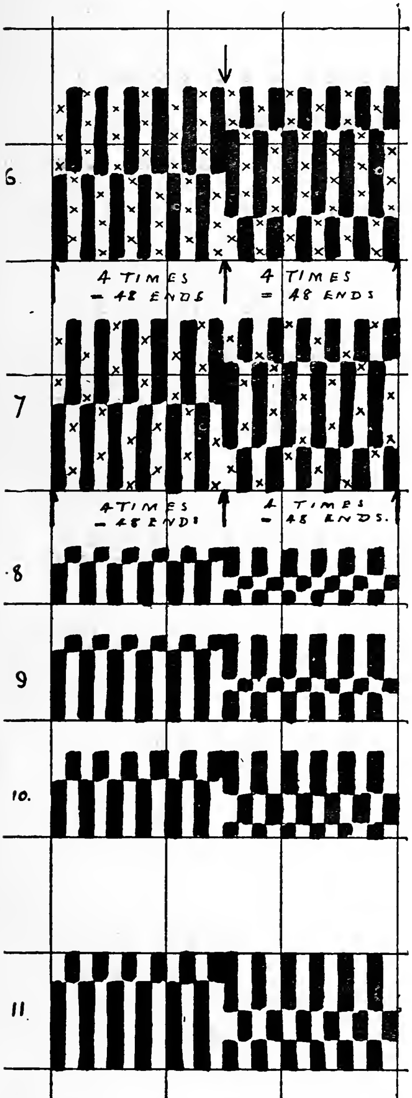
Section A, or B, of Fig. 2 is simply repeats of warp cord weaves. Each section represents six repeats of the two end cord, Fig. 3, and if woven alone would form an unbroken cord or rep effect across the cloth. The greater the number of ends in each section of the weave, as compared with the number of picks, the more pronounced will be the cord appearance. The nearer square the complete pattern appears in the cloth, the more will it resemble a basket effect.

The patterns vary from square to effects several times longer filling way than length way of the cloth.

When constructing cloths with warp cord weaves, of which barathea weaves are an extension, considerably more ends than picks per inch are required, the object being to cover the filling yarns entirely.

Barathea fabrics in all silk, or with silk warp and cotton filling, are extensively used in the manufacture of gentlemen's neckties. They are usually shown in white, black, solid and

staple colors, although occasionally made in more than one color.



The construction of two of these fabrics is as follows: White, fine silk warp, ply cotton filling, weave, Fig. 2; 280 ends and 72 picks per inch; 23 1-3 ribs per inch. Black, fine silk warp, ply cotton filling, weave, Fig. 4; 480 ends and 100 picks per inch; 10 ribs per inch. They are seldom made with larger effects than this for tie silks.

Baratheas are excellent wearing fabrics, the yarns exposed to wear, the warp yarns, being necessarily fine and of good quality. They are made to differ in the sizes of ribs used, small effects being used more than large ones. The size is regulated by one or both of two factors; first, the number of ends and picks in a repeat of the weave; second, the number of ends and picks per inch of yarn in the cloth. Figs. 2, 4 and 5 are the weaves generally used, the number of ends in each section varying according to requirements.

The two sections comprising the repeat, no matter how many ends used, usually contain an equal number of ends.

With the weaves already noted the effect produced on the back of the cloth is an exact duplicate of that on the face. A modification or extension of these weaves, used principally in the larger effects, is shown in Figs. 6 and 7.

The solid marks in Fig. 6 indicate a weave that would form an effect on the face of the cloth similar to that made with weave Fig. 4. These represent where the warp would show on the face, coming together and covering the raisers indicated by the crosses. The latter indicate a broken plain weave on the back.

Fig. 7 would make the same face effect in the cloth as Fig. 4, if woven with the same construction, but the back of the cloth would show a broken twill effect. A firmer fabric would be produced with weaves 6 and 7 than with No. 4, with the same amount of material.

Further extensions of these weaves are illustrated in Figs. 8, 9, 10 and 11.

The patterns indicated may be woven on ordinary single box silk dobby looms. If two colors are used in the same fabric they are arranged in the

warp. As the warp covers the filling there is nothing to be gained by using more than one color of filling.

LOOP or KNO CLOTH

Loop or kno cloths are characterized by small loops of warp yarn projecting from the face of the cloth, usually in set, regular order.

They are novelties, not standard goods, and as such are not limited to any one construction, quality or material. They are generally made with cotton, wool or silk yarns. The yarns forming the loops are used for ornamental purposes only.

Fig. 1 is an example of a loop pattern on a $\frac{2}{2}$ twill ground. The loop yarns in this particular instance

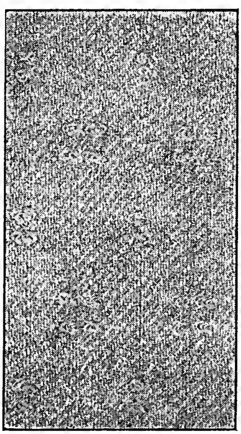


Fig. 1.

are arranged as extras, not showing on the face of the cloth, except where they are required to form the loops. Figs. 2, 3 and 4 show the weave, harness draft and chain draft respectively to produce Fig. 1. The ground ends are drawn through harnesses 1, 2, 3 and 4, and the loop yarns through 5, 6, 7 and 8. The weave is complete on 52 ends and 60 picks, including 4 wire picks.

THE LOOP YARNS

weave $\frac{1}{3}$, except where they are required to loop, and are tied between two face ends raised on opposite sides of the ties. Crosses in Fig. 2 show where the loop yarns are raised over the wires to form the loops. Circles indicate tying points, two ends working together as one. Crosses in Fig. 4 indicate where the wires go between the warp yarns in place of the regular shuttle. All the face warp is down, and the take-up motion of the loom is stopped on these picks.

THE CONSTRUCTION

of sample Fig. 1 is 85.8 ends and 66 picks per inch average. The ground cloth is 66 square and there are 12 loop or extra ends to every 40 ground ends. The warp is all two-ply yarn of similar count. The filling is single yarn.

LOOM REQUIRED.

Loop effects may be woven on loop pile carpet looms, or on ordinary dobby or jacquard looms provided with special mechanisms or attachments, and beam stands, upon which one or more extra beams may be placed, varying according to requirements. The loop yarns take up faster, and more intermittently, than the ground yarns, requiring a greater length of warp for a given length of cloth.

There are

VARIOUS METHODS

by which the loops may be obtained, each of which requires different attachments. Some of these are as follows:

First. The loop yarns are arranged to work gauze or leno in connection with wires fastened to one or more of the harness frames. These yarns go from one side to the other of the wires and as the cloth is drawn down, slide over and away from them and are feft in loops.

Second. Wires are inserted across the cloth in place of the regular shuttle, on the picks required to form the loops, on the principle applied when

making loop pile carpets. These wires are automatically withdrawn after the ground filling has secured the loops.

Cloth illustrated in Fig. 1 has been made on this principle. Two extra spools or beams have been used, one for ends on 5 and 6, and one for ends on 7 and 8.

Third. The loop yarns are allowed to come off the warp beam at about the same tension as the ground ends, except on the picks when they are required to loop, when they are forced forward a greater length by a positive motion. On these picks the yarns are eased after the shuttle has crossed the shed, and the shed closed before the reed reaches the fell of the cloth. This is perhaps the simplest method.

Fourth. The loops may be made on a loom with a terry reed motion (see article on terry toweling), but this is liable to make the cloth look barry where the three picks are beaten up together, as the ground ends offer considerably more resistance than on an ordinary terry towel fabric, there being only a relatively small portion of the ends weaving terry.

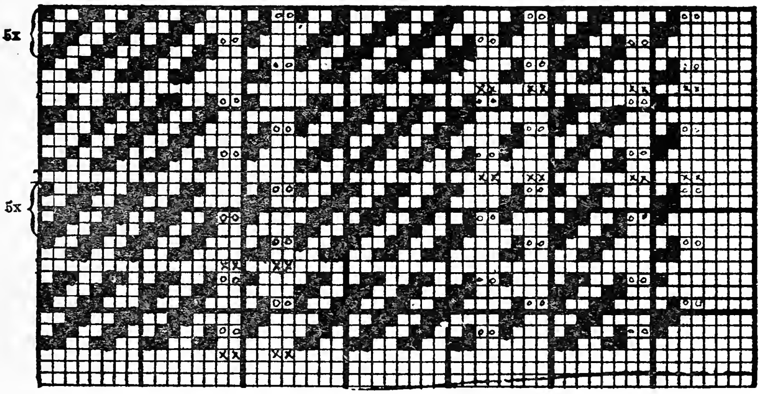


Fig. 2.

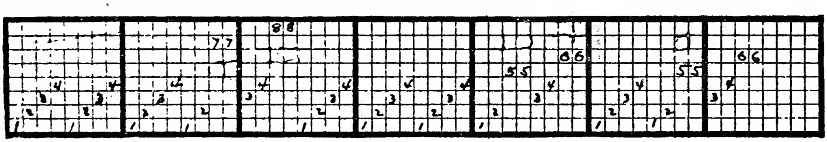


Fig. 3.

Dyeing Particulars.

LIGHT SLATE.

One per cent diamine black BH.; 1 per cent sal soda; 20 per cent Glauber's salt.

ECRU.

One-half per cent diamine catechine G.; ¼ per cent diamine fast yellow B.; 1 per cent sal soda; 20 per cent Glauber's.

NAVY BLUE.

Eight per cent immedial new bluo G.; 10 per cent sodium sulphide crystals; 2 per cent caustic soda lye, 75

degrees Tw.; 30 per cent Glauber's.

BOTTLE GREEN.

Eight per cent diamine black H.W.; 2 per cent diamine fast yellow B.; 2

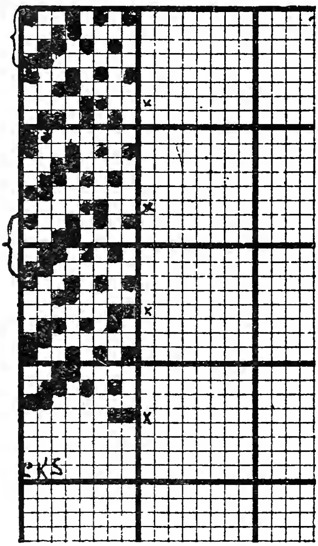


Fig. 4.

per cent sal soda; 20 per cent Glauber's salt.

GRAY.

One per cent immedial black NLN.; 1 per cent sodium sulphide; ½ per cent caustic soda solid; 20 per cent salt.

MAROON.

Five per cent immedial maroon B.; 6 per cent sodium sulphide; 1 per cent caustic soda solid; 20 per cent salt.

MODE.

One per cent immedial brown BV.; 1 per cent immedial yellow D.; 2 per cent sodium sulphide; ½ per cent caustic soda solid; 20 per cent salt.

GREEN.

Eight per cent immedial green GG.; 10 per cent sodium sulphide; 2 per cent caustic soda solid; 20 per cent salt.

BLACK.

Six per cent para diamine black BB.; 2 per cent sal soda; 20 per cent salt.

RED.

Five per cent diamine fast red F.; 2 per cent sal soda; 20 per cent salt.

PEA GREEN.

One-half per cent diamine green G., 1 per cent sal soda; 10 per cent salt.

SKY BLUE.

One per cent diamine sky blue FF.; 1 per cent sal soda; 15 per cent salt.

CREPONS

These fabrics are made up of a combination of cotton worsted, or cotton, worsted and silk. The goods are usually piece-dyed and used principally for ladies' wear in the form of skirts. The character of the patterns for these fabrics is such that the best effects can only be obtained with the use of the jacquard loom. In this treatise we will consider the fabric as woven on the harness loom. The harness loom is utilized either because the manufacturer has no jacquard loom on hand or wishes to reduce the cost of weaving.

THE WEAVE

for these fabrics is based on the doubled cloth system. Under the head of doubled cloth we mean the combining of two separate textures into one fabric requiring separate warp and filling threads for each texture. Combining the two textures into one fabric is effected by interlacing the warp or filling threads, or both, of one texture into those of the other at regular intervals.

The pattern being effected with the warp and filling of one system of threads forms a raised figure on the face of the goods. This raised figure depends as much on the nature of the yarn as it does on the weave. The

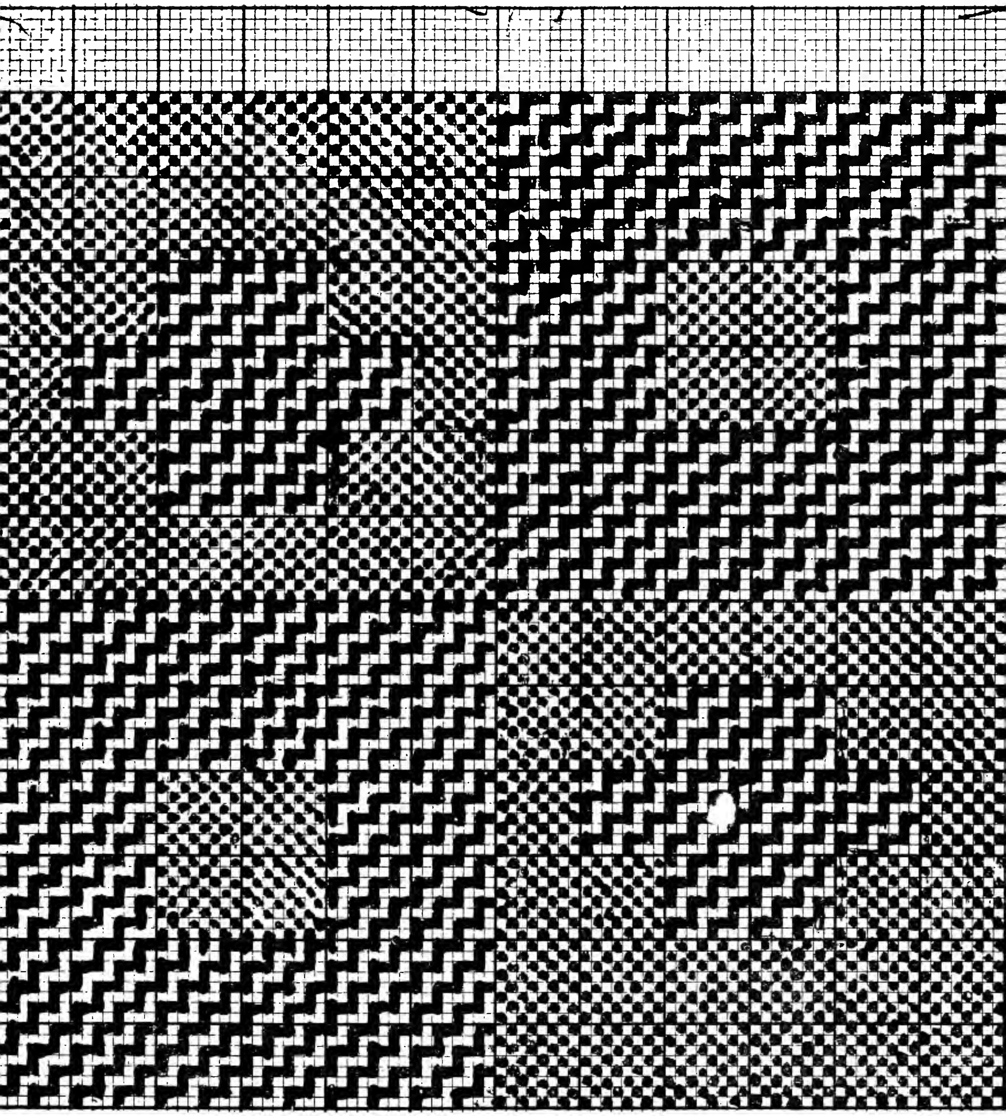


Fig. 1.

cotton in the goods is principally used as a back for the raised figure; the worsted forms the figure. If the silk is used, it forms the figures and the worsted or wool goes into the body of the goods, and in the finishing of the

fabric contracts considerably, thus accentuating the figure.

In a foregoing paragraph it was suggested that the best effects are only obtainable with the use of the jacquard loom, by reason of the fact that the patterns are too large to be operated on the harness loom, and as a rule the quality of the fabric is not made as fine as the jacquard loom fabric; however, a harness loom that can operate 24 harnesses can produce some very clever effects. The variety in regard to texture in these fabrics can be comprehended best by comparing several fabrics of different textures. Some idea may be obtained by the following constructions.

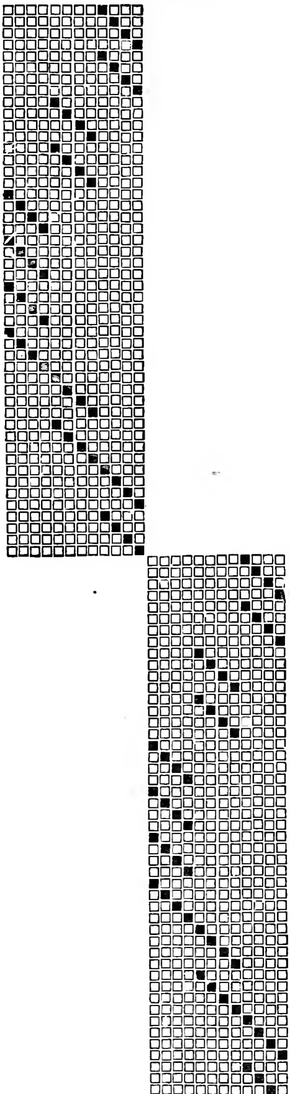


Fig. 2

A texture for a cheap grade crepon:

Width in reed, 56 inches; finished at 52 inches; warp plan, one end face warp, 2-32s mohair, 1 end back warp, 2-50s cotton; 15 x 4 reed; filling, 1-30s cotton filling; 60 picks.

A better grade may be made with the same warp plan, by using one pick worsted to alternate with one pick cotton. The worsted will be face filling.

The character of the pattern for this grade of crepon may be any conventionalized figure, arranged usually in some zigzag manner, imitating as much as possible the larger patterns made on jacquard looms. The raised figure or blister effect covers as much space or divides equally with the ground in most fabrics of the cheaper grades. In the better grades there is usually more figure than ground. Fig. 1 shows a design illustrating the crepon weave and proportion of figure to ground for fabrics on 20 to 24 harnesses. Fig. 2 shows the drawing-in draft.

A texture for a fine grade of crepon that may be woven either on the jacquard or harness loom:

Warp arrangement, 4 ends face warp, 2 ends in 1 heddle, 1¼ dram silk; 20 x 3 reed; 1 end back warp, 2-60s cotton; filling 3 picks, 1 dram silk, 1 pick, 2-30s worsted; 80 picks per inch, 60 face picks, 20 back picks.

This construction can be made up to the best advantage, in regard to pattern, with the jacquard loom.

In finishing the cheaper grades, wherein the fabric is made up of cotton and worsted, the cotton yarn is dyed before it reaches the loom. After the fabric is woven it is dyed for the worsted. The prevailing color for

these fabrics is solid black. The worsted in the goods contracts considerably during the finishing, producing the blister effect by which the goods are characterized.

Carding and Spinning Particulars.

Crepon is made up in many different ways and out of different fibres, sometimes wool and cotton yarns being employed. Other combinations are cotton and silk, wool and worsted, all wool, all worsted, all cotton, etc. When the same fibre is used throughout the cloth, the twist put in the yarn plays a very important part. For example, one yarn, generally the warp, is very tightly twisted, while the filling yarn is stock twisted. When the cloth constructed from these yarns is dyed, the action of the dye on the yarns is entirely different and contracts one more than the other, thus causing the raised or puffed effect of crepon.

ANOTHER METHOD

used is to have part of the warp yarn with the regular twist, while another part has a reverse twist put in, the effect produced being the same as before. In the cloth under description the backing or picking warp is to be 2-60s cotton yarn. To produce this yarn the mechanics' data, etc., required would be as follows: The mixing should be as large as possible and should be allowed to stand at least 48 hours before being used, so that the cotton will have become thoroughly expanded.

THE COTTON

should be of a good middling grade and of 1 5-16-inch staple. The raw stock is passed through an opener and three processes of picking. The hopper of the opener should be kept full of cotton, a small percentage of good waste from the machines up to the slubber being put in at this machine. The speed of the beater, which is generally of the two-bladed, rigid type, should be at least 1,500 revolutions per minute. The weight of the lap at the front end should be 40 pounds, or a 16-ounce lap (the total weights given are for a lap 40 yards in length). Four of these laps are put up at the intermediate picker and run through and made into a lap weighing 38 pounds, or a 10-ounce lap. The speed of the beater for this machine is 1,450 revolutions per minute. These laps are in turn put up at the back of

THE FINISHER PICKER.

The speed of this beater is 1,350 to 1,400 revolutions per minute. The weight of the lap at the front is 39 pounds, or a 14½-ounce lap. Every lap should be weighed and all laps varying more than one-half a pound from the standard should be put to the back of the finisher picker and run through again. It is very important to see that this is done, because nothing will throw yarn numbers off more quickly than laps that vary.

Another important question in the picker room is what to do with the

CUT-ROVING WASTE.

Of course, the best thing to do is not to make it. As it is made, the next question is how to use it up. Up-to-date mills are installing a cut-roving waste machine in their plants, but there are a great many mills which have no such machine. In this case the waste is put through the intermediate picker, the two center laps at the back of the picker being removed and the waste spread evenly between the two remaining laps. To help stop these laps from licking, four or six ends of slubber roving are run into the lap at the front end of the picker. These laps are run in with the raw stock laps at the back of the finisher picker in the proportion of one lap of cut waste to three laps of cotton as long as they last. As little cut waste should be run as possible, because it not only causes licking laps, but it

CAUSES UNEVEN WORK

and weak roving and yarn; it is continually breaking back in the creels, requiring one and sometimes two teeth of twist more than when not used.

The laps from the picker are put up at the card, the setting of which should be the same as given in previous articles when the same grade and staple of cotton were used. The speed of the flats should be one complete revolution every 37 minutes. The speed of the licker-in should be 300 revolutions per minute. The production should be about 550 pounds for a week of 60 hours. Watch all the setting points. Set at least once a month all over. Grind cards lightly and often. Strip three times a day and keep cards as clean as possible and well oiled. Doff cans when full and don't allow them to become so full that they fall over. Care should be taken that no single or double is allowed to pass through.

The

DRAFT OF THE CARD

for this kind of work should not be less than 100 and the sliver should weigh 50 grains. This sliver may be either combed or passed directly to the drawing frame. Generally, however, it is combed. Different methods and machines are used nowadays for combing, but the general method is to have the card sliver run through a sliver lap machine, where it is doubled 14 into 1, and the weight of the lap is 300 grains per yard. From here it is passed to the ribbon lap machine and doubled 6 into 1. The weight of a yard of lap at this machine is 290. From here it is passed to

THE COMBER

and doubled 6 into 1, the weight of a yard of sliver being 60 grains. At the ribbon lap machine the laps should be sized once a day, and if the weights are coming uneven, twice or even three times a day. The comber sliver is next put through two processes of drawing, the doublings being 8 into 1 at the breaker and 6 into 1 at the finisher. The weight of sliver at the finisher is 80 grains per yard. This cotton is then put through the slubber and made into .40 hank roving. At the first intermediate the roving is 1 hank and at the second 3 hank, while at the jacks the roving is 12 hank. Be careful of the settings of the rolls. They should not be spread too far apart, causing a strain, nor should they be so close as to cause a breaking of the fibre. The 12-hank roving is spun into 60s on a spinning frame having a $2\frac{3}{4}$-inch gauge of frame, $1\frac{1}{2}$-inch diameter ring, and a 6-inch traverse. The twist put in is in excess of that generally used for warp yarn, sometimes as high as 6.40 times the square root of the count being used, instead of 4.25, the usual twist. After being spun, the yarn is spooled and twisted into 2-ply 60s yarn, after which it is warped and run through the slasher and beamed.

Dyeing Particulars

Crepons are woven sometimes with a black warp, dyed with sulphur black and piece dyed with wool colors.

BLACK.

Five per cent anthracene chrome black PF.; 4 per cent acetic acid; 1 per cent oil of vitriol. Boil 45 minutes. After-chrome with 1 per cent bichrome 30 minutes.

NAVY BLUE.

Four per cent azo chrome blue TB.; 4 per cent acetic acid; 1 per cent oil of vitriol. After-chrome, 1 per cent bichrome 30 minutes.

The warps are also colored with immedial sulphur colors to shades required and dyed in the piece with wool colors.

BROWN.

Two per cent anthracene chrome brown DW.; 1 per cent anthracene acid brown G.; ½ per cent anthracene yellow BN.; 3 per cent oil vitriol. After-chrome, 1½ per cent chrome.

PEARL.

One-quarter per cent anthracene chrome blue G.; 1 per cent oil of vitriol. After-chrome, 2 ounces bichrome.

SLATE.

One per cent anthracene chrome blue G.; ⅛ of an ounce anthracene yellow BN.; 2 per cent oil of vitriol.

After-chrome, 1 per cent bichrome.

MODE.

Four ounces anthracene chrome blue G.; 2 ounces anthracene chrome red A.; 1½ ounces anthracene yellow BN.; 2 per cent oil of vitriol. After-chrome, 1 per cent bichrome.

SNUFF BROWN.

One-half per cent anthracene chrome red A.; 1½ per cent anthracene chrome brown D.; 1¼ per cent anthracene yellow BN.; ¼ per cent anthracene chrome blue F.; 3 per cent oil of vitriol. After-chrome, 1½ per cent bichrome.

GREEN.

Three per cent anthracene chrome blue G.; 1 per cent brilliant milling green B.; 1½ per cent anthracene yellow BN.; 4 per cent oil of vitriol. After-chrome, 2 per cent bichrome.

WINE.

Two per cent wool red B.; 1 per cent anthracene chrome blue R.; 3 per cent acetic acid; 1 per cent oil of vitriol. After-chrome, 1 per cent bichrome.

SAGE.

Two ounces anthracene chrome blue BB.; 2 ounces anthracene yellow BN.; 1-16 ounce anthracene red A.; 1 per cent oil of vitriol. After-chrome, 1 per cent bichrome.

SHADE CLOTH

Shade cloths for window shades, window curtains or window blinds derive their name from the use to which they are intended to be subjected. They comprise a large variety of counts, widths, weights and qualities. The lower grades are made from low to medium qualities of stock, extending to the usual grades of print cloth fabrics. Better grades are made in all numbers of cotton to the best Egyptian and Sea Island.

The widths vary from a few inches for small door and house windows to three or four yards, or more, for large plate glass store windows. The general run of goods is of medium width. The narrow shades are made by cutting a wider cloth in two or more sections or narrow widths. For example, a shade cloth finishing 54 inches wide might be cut in three strips, each of which would be 18 inches in width. The

MEDIUM-WIDTH GOODS

are woven in one width, with two selvages only, one on each side. It is not necessary to have special selvages for each width (for cloth to be cut up into two or more widths) because the sizing or filling put onto and into the goods during the finishing process prevents the edges from unraveling for a considerable time after they have been cut if they are handled with due care.

The wide shade cloths are usually considerably heavier in proportion than the narrow goods on account of the extra hard usage to which they are subjected.

THE DISTINGUISHING FEATURE

of these goods is in the smooth, polished and firm appearance of the same after they have been finished. They are usually finished in white or solid colors, or with a printed heading in addition.

The cloth basis of the shade may be any one of many of the plain woven cloths that have been described, with the possible extension in width as noted.

A shade cloth under consideration has a plain cloth for a basis of the following construction: Width, 44 inches; ends per inch, 64; picks per inch, 64; length, 100 yards; weight, 3⅛ yards per pound; warp counts, 22s; filling counts, 24s. The finished width of this cloth is 42 inches.

LOOM REQUIRED.

The loom required will vary in slight details according to the weight and width of cloth required. For narrow goods the automatic or quick running plain looms will answer all requirements, the weave being plain in all cases, with one warp and one filling only required.

The principal change necessary to

weave wide fabrics is in placing two or more warps in the loom, end to end, instead of one large beam. These sectional warps are run on shells instead of solid beams. The rod running through them all is supported on bearings between every two shells, as well as at the ends, when in the loom.

Combining warps in this manner obviates the necessity of having to prepare them on a very wide slasher, which would otherwise be necessary to accommodate the wide beam, as well as overcomes the difficulty caused by long beams warping and getting out of true.

FINISHING.

The cloths are woven white, then piece-dyed in the color or tint required.

One method of finishing 42-inch shade goods is as follows: Shear and singe on both sides so that all loose fibres are dispensed with; wash, bleach, dye, mangle and dry. After being cooled, run through a damping machine and allow to remain in a damp state for a short time, then stretch on the belt-stretching machine to 43 inches in width, after which fill on the friction starch mangle with the following mixture: Maize or cornstarch, 100 pounds; oleine oil, 50 per cent, two quarts; carbolic acid, one-half pint. Water sufficient to make, when boiled, 100 gallons. After filling, dry on drying machine and allow to cool; run through damping machine and allow to lie at least two hours. Run through wide or Scotch hydraulic mangle; strip, turn and repeat the process. Strip, run through canroy machine.

For white shade cloth the dyeing process is not necessary. Fancy shade cloths, in addition to the processes noted, are run through a printing machine for the purpose of receiving a pattern at one end of each shade. The color or tinsel applied is of a firm character. The patterns are printed every so often in the piece, according to the length of shade required, and extend from side to side.

Carding and Spinning Particulars.

For carding and spinning particulars the reader is referred to the warp data in the article on "Buckram," and to the filling data in the article on "Book Muslin."

Dyeing Particulars.

These goods are dyed on the jig in rolls of about 10 pieces of 50 yards, with sulphur colors.

ECRU.

One-half per cent immedial cutch G.; ⅛ per cent immedial yellow D.; 1 per cent sulphide sodium; 1 per cent soda ash; 20 per cent salt; after-chromed with ½ per cent chrome.

OLIVE.

One per cent immedial yellow D.; 2 per cent immedial dark green B.; 2 per cent immedial olive B.; 5 per cent sulphide sodium; 2 per cent soda ash; 25 per cent salt; after-chrome with 1 per cent chrome.

NAVY BLUE.

Ten per cent immedial blue B.; 2 per cent immedial indone R.; 12 per cent sulphide sodium; 2 per cent caustic soda; 25 per cent salt.

DARK GREEN.

Ten per cent immedial green BB.; 10 per cent sulphide sodium; 2 per cent caustic soda; 25 per cent salt.

MAROON.

Ten per cent immedial maroon B.; 10 per cent sulphide of sodium; 2 per cent caustic soda; 25 per cent salt; after-treat with 1 per cent chrome.

SLATE.

One per cent immedial black NLN.; 1 per cent sulphide sodium; 1 per cent caustic soda; 10 per cent salt; after-treat with ¼ per cent chrome.

RED.

Eight per cent diamine fast red F.; 2 per cent sal soda; 30 per cent salt; after-treat with 1½ per cent fluoride of chrome.

BROWN.

Five per cent immedial brown B.; 5 per cent immedial brown G.; 10 per

cent sulphide sodium; 2 per cent caustic soda; 25 per cent salt; afterchrome with 1½ per cent chrome.

BISHOP'S LAWN

Bishop's lawn is a fine, plain woven fabric, slightly lighter in weight than linon or India linon. It is a white fabric with a blue tint, and is principally used for light dresses and underskirts.

Like a great many other plain cotton goods, bishop's lawn varies slightly in weight, count and quality, but the latter is usually very good.

The finish and blue tint seen in these goods are the principal characteristic features which distinguish them from other fine cotton fabrics. A cloth of the same construction and quality might be known by another name if finished differently.

The

ANALYSIS

of a bishop's lawn of good quality indicates the following construction: ends per inch, 104; picks per inch, 112, warp counts, 100; filling counts, 120; finished width, 27 inches.

The ground of the fabric is reeded two ends per dent. The selvage is neat, the yarns being arranged in a somewhat unusual manner. From the ground cloth outward, they are as follows:

12 ends singles in four dents; 24 ends as 12 in six dents; 8 ends as 2 in one dent; total, 44 selvage ends in 11 dents on each side.

The selvage and ground ends are of the same counts.

CALCULATIONS.

To find number of ends in warp: 104 (sley) divided by 2 (ends per dent) equals 52 dents per inch; 52 x 27 (width) equals 1,404 dents occupied by warp; 1,404—22 for selvages equals 1,382 dents for ground; 1,382 x 2 equals 2,764 ground ends plus 88 selvage ends total 2,852 ends.

To find width in reed, assuming 10 per cent shrinkage from warp to finished cloth: 27 inches divided by .90 or 90 per cent equals 30 inches in reed.

To find weight of warp, assuming 105 yards of warp for 100 yards of cloth:

$$\frac{2{,}852 \text{ (ends)} \times 105 \text{ (length)}}{100 \text{ (counts)} \times 840} = 3.565 \text{ lbs. warp in 100 yards cloth.}$$

To find weight of filling in 100 yards of cloth:

$$\frac{112 \text{ (picks)} \times 100 \text{ (length)} \times 30 \text{ (width in reed)}}{120 \text{ (counts)} \times 840} = 3.333 \text{ lbs. filling.}$$

To find weight of cut:

3.565 lbs. warp.
3.333 lbs. filling.

6.898 lbs. weight of 100 yard cut.

To find number of yards per pound: 100 (length) divided by 6,898 (weight) equals 14.49, say 14½ yards per pound.

LOOM REQUIRED.

This fabric may be woven on any of the light running cam, single-box looms. One beam only is required. On account of the large number of ends per inch, care should be taken not to have a coarser twine harness than is absolutely necessary. If difficulty is experienced with crowded heddles and ends, the cone motion may be substituted for the cams with advantage.

FINISHING.

After being prepared and bleached in the ordinary manner, the goods are opened out to the full width and run through a light starch, blued to suit requirements, on a starch mangle, and dried. They are then dampened, calendered on a "swissing" or "rolling" calender, folded and made up as required.

Carding and Spinning Particulars.

Bishop's lawn is made in mills having the equipment of machinery as given in the third division, i. e., machines for making fine counts of yarns.

On this class of goods the sampling of the cotton as to grade and staple is a very important part in the finished fabric. The counts of the yarn of the sample of the cloth taken for description are for the warps 100s and for the filling yarn 120s. For these counts the cotton used would be Sea Island and the staple 1⅝ inches. Every bale should be graded and stapled before it is allowed to be put into the mixing, and this mixing should be allowed to stand as long as possible and also should be as large as convenient. For this class of cotton it would be better if it were opened and put through a blower and then sent through a line of trunking, so that it would be dried out as much as possible before being worked.

ONLY TWO PROCESSES

of pickers and an opener are used for this cotton, because it should have as little beating as possible to get the dirt out. The usual instructions that have already been given, relative to the opener and pickers, should be followed. The speed of the breaker beater (which should be of a two-bladed, rigid type) should be 1,350 revolutions per minute, and the lap in front should weigh 29 pounds. These laps are put up at the back of the finisher picker and doubled 4 into 1. The speed of this beater should be 1,200 revolutions per minute, which gives the cotton passing through about 29 beats or blows per inch. For this class of goods it is not the general custom to mix in cut waste. The picker room should be looked after to see that all the eveners are working properly and to try and make laps that don't split. In order to do this, look after

THE DRAFTS

to see that they are putting the cotton passing through the picker in the proper place. At the finisher picker the laps, as they are taken off, should be weighed, and all those having a variation of half a pound either side of standard should not be allowed to be put up at the card, but should be run over again. The total weight of a lap at the finisher should be 30 pounds or a 10-ounce lap. These laps are put up at the card. This card should be set close at the points between the cylinder and doffer and cylinder and flats and also between the cylinder and licker-in, but between the licker-in and feed plate the setting should be so that the distance between the bite of the feed roll and teeth of the licker-in is just a little greater than the length of the staple. It is

A GENERAL FAULT

of carders to set these two parts the same for all lengths of staple, and this should be looked after and remedied, because if the proper distance is not maintained between these parts the stock will be shorter in length at the front (if set too close), or will not be properly carded (if set too far apart). For long-staple cotton, some overseers claim that it is an advantage to reduce the speed of the licker-in. Their reason for so doing is they claim that the licker-in is nothing more or less than a beater, and if we slow down the beater for long-staple cotton, why not slow down the licker-in in the same proportion? The wire fillet used on the cylinder should be No. 110s, or No. 34s wire, and for the doffer and top flats No. 130s, or 36s wire. The

SPEED OF THE FLATS

should be one complete revolution every 38 minutes and the licker-in 30 revolutions per minute. The cards should be stripped three times a day, and ground at least once a month. The flats should be ground so as to always have a sharp needle point. If possible, the flats should be taken off and ground on a flat grinding machine and it will be found that the best results will be obtained. The production of a card for a week of 60 hours should be 225 pounds; the weight of the sliver, 35 grains per yard; the draft of the card being 125. In this article, we have drafted high and carded light. In some cases, for this kind of goods and cotton, overseers have been known to draft as high as 180, which makes our draft of 125 look rather small. After passing the cards, the sliver is put through either a line of drawing

or a sliver lap machine, according to the layout of the mill. In mills that are now being built and in the old mills that are installing new machinery, the combers being put in are of different types and some prefer the new style single head comber, while others prefer the older style 8 head comber or 6 head comber as the case may be. The single head comber seems to have some preference among mill men, inasmuch as it does not take up any great amount of space and accomplishes a great deal of work.

The weights, etc., that we give in this article will be for the older type of 8¾-inch width laps. The weights for larger laps may be obtained by proportion. We will also assume that the equipment is as follows: Sliver lap, ribbon lap and combers.

The doubling at the sliver lap machine is 14 into 1, and the weight of the sliver is 225 grains per yard. At the ribbon lap machine the doublings are 6 into 1, the weight of a yard of lap being 200 grains per yard. In some mills, the sliver laps are made a little heavier and only five doublings used at the ribbon lap. When this is the case, the weight of a yard of sliver lap is 270 grains per yard.

For the top leather rolls of these machines use a

VARNISH

as follows: Seven ounces gelatine glue, one quart acetic acid, two teaspoons oil of origanum. Color with burnt sienna. In dog-day weather or for slippery cotton use ground charcoal and gum arabic. This varnish may be also used for the drawing frames and comber rolls (both detaching and those in the draw box). The laps from the ribbon lap machine are put up at the comber. At this machine the percentage of waste taken out is 22 to 25. The speed is 85 nips per minute. The rolls should be varnished at least once every two weeks, needles picked and brushes cleaned once a week. Comber percentages should be taken every time a comber is changed from one stock to another and the percentage of four every day. Set comber same as for Indian lawn. The weight of the sliver should be about 35 grains per yard. The comber cans should be put up at the back of the drawing frame, being doubled 6 into 1 at both the breaker and finisher. The

WEIGHT OF THE SLIVER

at the finisher drawing should be 65 grains per yard. Watch the stop-motions to see that they are all in proper working order and also the roll settings; also keep the rolls well varnished. At the slubber the drawing is made into .80 hank roving, after which it is put through three processes of fly frames. At the first intermediate it is made into 2.25 hank, at the second into 5, and at the fine frame into 20 hank for warp yarns; for filling yarns the slubber and first would be the same hank, at the second intermediate the hank is six and at the fine frame, 24 hank. Watch the build of the bobbins, the lay, twist and tension. Also keep a sharp watch on double and single, also bunches. Sometimes the slubber and first intermediate top leather rolls are varnished, the varnish used being a little lighter than that used for drawing frames.

THE ROVING

is spun into 100s from the 20 hank roving on a warp frame having 1⅜-inch diameter ring, 5-inch traverse, and spindle speed of 9,400 revolutions per minute. This yarn is then spooled, warped and put through the slasher, at which the following size may be used: 100 gallons of water; 75 pounds potato starch; 7 pounds tallow; 3 pounds Yorkshire gum; 2 pounds white soap; boil two hours and let stand 10 hours before using. Keep agitator running and size almost at boiling point.

The 24 hank roving is made into 120s yarn on the mule.

Dyeing Particulars.

PINK.

One-half per cent rose B D.; 1 per cent sal soda; 10 per cent salt.

SKY BLUE.

One-quarter per cent diamine sky blue F F.; 1 per cent sal soda; 10 per cent salt.

CREAM.

Two grains diamine catechine 3 G.; 1 per cent sal soda; 10 per cent salt.

ECRU.

Two per cent diamine catechine 3 G.; ¼ ounce diamine fast yellow B.; 1 per cent sal soda; 10 per cent salt.

PEA GREEN.

Two ounces diamine green B.; 1 per cent sal soda; 10 per cent salt.

RED.

Five per cent diamine fast red F.; 2 per cent sal soda; 20 per cent salt.

SAGE GREEN.

One per cent diamine green G.; 1 per cent sal soda; 15 per cent salt.

WINE.

Four per cent diamine Bordeaux B.; 2 per cent sal soda; 25 per cent salt.

SCARLET.

Three per cent diamine scarlet B.; 2 per cent sal soda; 25 per cent salt.

ROYAL BLUE.

Five per cent diamine sky blue; 2 per cent sal soda; 25 per cent salt.

ROBES

A cotton fabric with an unglazed surface, printed on one side in highly colored patterns, this fabric is made up into robes, wrappers or gowns, hence the name. The fabric was originally produced in cashmere effects, and used primarily as a dress fabric.

This fabric, however, resembles in point of texture and general appearance the cloth known as "cretonne," which is also a printed cloth, but used principally for furniture coverings, curtains, comfortables and such purposes. The term robes is applied to both twilled and plain woven fabrics. The fabric used for robes is usually made from a 64-square printing cloth, or its equivalent, while the fabric used for household purposes is made from various textures.

The

CHARACTER OF PATTERNS

for robes is almost without limit, but the scale, or size of the figure in the design, however, should not be too large, as the numerous folds would destroy the effect of the repeat of the design. The designs best suited for this class of goods are small floral or geometrical figures, distributed in such a manner that they will not appear in the finished garment in rows or lines, but rather in an all-over effect, so that the various figures constituting the design may be seen at a glance.

THE COLORINGS

may be almost any conceivable combination imaginable, providing, of course, that there be harmony in the colors used. The number of colors used varies from 4 to 10 different shades, the darker colors usually forming the background, while the lighter and brighter colors form the figures.

In regard to the construction for these fabrics the designer has little in the way of ingenuity, the important feature of the goods depending on the printing machine.

The fabric is composed of plain cotton yarn with

THE COUNTS

varying very little, a common texture being 64 ends and 64 picks, of 1-30s both warp and filling, sometimes arranged 70 ends and 58 picks, another texture being made with 64 ends and 48 picks, 1-30s warp and 1-26s filling, made in widths from 27 to 36 inches.

The goods are woven on high speed looms. The automatic loom is well adapted for this class of goods. The cost of weaving is an important consideration in the production of these goods, as the retail price does not warrant an unnecessary expense.

FINISHING.

The goods, after being woven, are prepared for the printer by boiling off, then passed over heated cylinders to dry, after which they are ready for printing. After the printing process they are ready for the merchant.

Carding and Spinning Particulars.

The yarns to make robes are manufactured in the first division of mills as given in a previous article. The mixture for this cloth varies according to the mill making

the goods and also the quality of the goods required of the manufacturer. Generally speaking, there is a certain percentage of waste used for this class of goods, and not only the percentage differs, but the quality of the waste used also. Some mills will use only comber waste, and other mills only comber and card waste, while other mills will use any kind of waste they can obtain, and run it through. The mixing plays an important part and the percentage of waste put in varies from 10 to 100 per cent. Production and plenty of it is the cry of the owners making this class of goods. This being the case, quality is somewhat lacking. To make up for this, the goods are brushed, which has a twofold advantage. It gives a

NAP

to the goods, as well as hides the neps in the cloth. When good raw stock is used, the length of staple is short, rarely being over 1-1-16 inches in length. The counts for the sample of cloth under description are 30s for both warp and filling. The mixings are made, as before stated, large and with the proper proportion of waste mixed in. This is then run through three processes of pickers, first being run through an opener. This opener has a fan, which makes 165 revolutions and carries the cotton to the aprons of the breaker picker and leaves the cotton in an open, airy state. This lattice or apron carries the cotton to the feed rolls of the beater. This beater is of the two-bladed type and makes 1,500 revolutions per minute. The proper drafts should be maintained at both pickers, so that a hard lap will be made. There are several methods by which, it is claimed, the laps may be made and will run off smoothly and without licking, but as near as can be found out by experimenting, no one remedy will fill all conditions. Judgment at this point is needed. The weight of a full lap at the head end of the breaker picker should be about 16 ounces per yard. These laps are put up at the intermediate picker and doubled 4 into 1. This picker is equipped with a two-bladed, rigid type of beater and has a speed of 1,450 revolutions per minute.

THE TOTAL WEIGHT

of a lap from this machine is 37 pounds or a 10-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. This picker has the same style of beater as the other two; the speed is, however, slightly reduced, being 1,375 revolutions per minute. The total weight of a lap is 39 pounds, or a 14½-ounce lap. In some mills they omit the intermediate process of pickers, using just the breaker and finisher, and for this class of goods would advise two processes of picking. The laps are put up at the card. For this class of work the draft of the card does not exceed 90 and very often is not more than 85. The card fillet used on both the doffer and cylinder, as well as the flats, is coarse. The general count used is No. 33 wire or No. 100s for cylinder and No. 35 or No. 120s count for the doffer and flats. The settings used for this class of work are similar to those given for indigo prints. The speed of the cylinder is 165 revolutions per minute; licker-in, 350 revolutions per minute; flats, one complete revolution every 50 minutes. The weight of the sliver is 65 grains per yard, and the production is from 850 to 1,000 pounds per week of 60 hours, according to the quality and quantity required.

THE CARD

for this class of work should be ground once a month and stripped twice a day, although in some instances the doffer is stripped a third time. The waste taken out should not exceed 8 per cent. After leaving the card the sliver is put through two processes of drawing, the doublings at the breaker being 6 into 1, and at the finisher 6 into 1. The weight of a yard of sliver is 75 grains. The speed of the front roll largely depends on the call for drawing, and the manner in which the room is balanced. As frequently happens, the drawing frame is the machine to get an increase in speed so as to keep up with the slubbers or cards, and to do so the speed of the front roll is increased. The speed varies from 325

to 450 revolutions per minute, according to requirements. As the drawing frame is the last machine that can really be said to even the sliver, care should be taken to see that all stop-motions are in perfect working order, and that they act quickly so as to prevent an end passing through before the frame stops. Whole sets of drawing or card sliver should not be put up at the back of the frame, because it tends to make uneven yarn. If a size at the front be taken when the tops of a can are running through, it will be found to be heavier than the standard; the middle about the standard, and when the can is almost empty it will size light. If the cans are equipped with springs, it will help overcome this defect to a large extent, and it will also help to stop the "breaking back" of the ends.

THE DRAWING

is put up at the back of the slubber and made into .60 hank roving, after which it passes through two processes of fly frames and is made into 2 hank roving at the intermediate, and 6 at the fine frame. The proper lay of the roving on the bobbin is 14 rows per inch for the 2 hank, and 33 lays per inch for the 6 hank roving. Twist jack roving so that it will bear its own weight when put in the creels at the successive machines. Be particularly careful about single, double and bunches. Sizing should be accomplished at the picker as follows: Every finisher lap should be weighed and if the weight varies more than half a pound, either side of standard weight, it is put back to be run over again. The cards should be sized once a week. The drawing frame finisher should be sized four times a day, and a variation of two grains to the yard either side of standard should mean a change. The fine roving is sized once a day and there is no hard and fast rule for changing.

The 6-hank roving is spun into 30s warp yarn on the spinning frame, 2 into 1 on a frame having a 1¾-inch diameter ring, 2¾-inch gauge of spindle, 6½-inch traverse and a spindle speed of 10,000 revolutions per minute. As soft a twist as possible is used so that it will nap well. The yarn is next spooled and warped, and run through a slasher. The 6-hank roving for the filling yarn is spun into 30s filling at the mule, as it requires a soft twist, for reasons before stated. After being spun it is taken to the conditioning room and remains there until wanted for use.

Dyeing Particulars.

NAVY BLUE.

Ten per cent immedial indone blue 2 B.; 10 per cent sulphide sodium; 4 per cent soda ash; 30 per cent salt.

GREEN.

Eight per cent immedial green G G.; 8 per cent sulphide sodium; 4 per cent soda ash; 30 per cent salt.

RED.

Six per cent diamine fast red F.; 2 per cent sal soda; 30 per cent Glauber's; after-treat with 2 per cent fluoride of chrome.

YELLOW.

Five per cent immedial yellow G G.; 5 per cent sulphide sodium; 30 per cent salt; 4 per cent soda ash.

OLIVE.

Four per cent immedial olive 3 G.; 4 per cent sulphide sodium; 30 per cent salt; 3 per cent soda ash.

BROWN.

Five per cent immedial brown B.; 5 per cent immedial cutch O.; 10 per cent sulphide sodium; 4 per cent soda ash.

MYRTLE GREEN.

Eight per cent immedial dark green B.; 8 per cent sodium sulphide; 4 per cent soda ash; 30 per cent salt.

ORANGE.

Ten per cent immedial orange C.; 10 per cent sodium sulphide; 4 per cent soda ash; 30 per cent salt.

BORDEAUX.

Ten per cent immedial Bordeaux G.; 10 per cent sodium sulphide; 4 per cent soda ash; 40 per cent salt.

SLATE.

One per cent immedial black N N.; 2 per cent soda ash; 1 per cent sodium sulphide; 25 per cent salt.

ECRU.

One per cent immedial cutch G.; ¼ per cent immedial yellow D.; 2 per cent sodium sulphate; 25 per cent salt.

BLACK.

Six per cent immedial brilliant black 5 B V.; 6 per cent sodium sulphide; 4 per cent soda ash; 50 per cent salt.

BENGAL STRIPES

Bengal stripes is a name given to a type of gingham consisting of white and colored stripes, alternately arranged in small effects in regular order, the colored yarn having been dyed with Bengal indigo.

They were originally made in Bengal, India, the home of some of the many species of the plant from which indigo is extracted, Indigo Fera, and derive their name from that fact. They differ from some other types of striped ginghams only in having colored warp yarns that have been dyed with Bengal indigo.

INDIGO

has been used as a dyestuff for hundreds of years and has attained a reputation for itself that is responsible for a continued call for indigo-dyed goods in the market, although similar appearing goods may be made much more cheaply with modern aniline dyes. Goods dyed with the latter possess more merit than most of the so-called indigo-dyed goods, the colors of which do not penetrate beyond the surface of the yarns.

Indigo dyeing, if done properly, requires more time than is now thought advisable or necessary to devote to any ordinary class of dyed goods and has been substituted to a very large extent by anilines. The amount of indigo used has been steadily growing less for a number of years, and it appears probable that there will be very little of it used in the commercial world a few years hence.

USES OF BENGAL STRIPES.

Bengal stripes are used principally for skirtings, aprons, etc. Fig. 1 is an illustration of a typical fabric, the analysis of which shows it to be an article that can be depended upon to wear well.

The warp yarns are arranged 8 of blue and 4 of white, alternately, the filling being all white. The white yarn in both warp and filling has been bleached before being woven. The blue warp yarn was dyed in the skein with Bengal indigo.

Many of the heavy fabrics in which color is used are now made more economically through the stock dyeing process. In this method the raw cotton is bleached and then dyed whatever color is deemed necessary. After this process is completed the cotton is handled exactly the same as if a grey woven fabric were to be made. The color penetrates into the center of yarns in this method, inasmuch as the stock is dyed in a loose state and the actual dyeing and manufacturing is more economically done than was formerly the case. Some concerns use colors which are absolutely fast in these heavy cloths, while others use less expensive materials, but the method of procedure is identical. Few new mills where staple fabrics with more or less staple colors are produced are being built to-day where the stock dyeing process is not used.

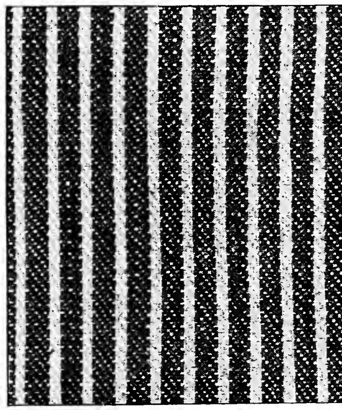


Fig. 1.

The fabric illustrated is practically a warp face cloth, the warp yarn showing very prominently in alternate

blue and white stripes, whereas the filling is almost hidden. Several factors tend to produce this effect, among which may be mentioned, first that two out of every three ends are raised on each pick, the weave being the 3-end warp flush twill to the left (Fig. 2);

Fig. 2.

second, that the warp yarns are harder twisted than the filling yarns and are approximately twice as heavy; third that the cloth contains considerably more ends than picks per inch.

ANALYSIS.

An analysis of the fabric shows the following construction data: Finished width, 29.7 inches; ends per inch, 67.2; picks per inch, 48; warp pattern, 8 blue and 4 white; warp counts, 9s; filling counts, 16s; yards per pound, 2.5.

Perhaps the simplest method of counting the number of ends per inch in a stripe pattern, and the most accurate, is to count the number of ends in each pattern; or if the latter is small, count several patterns on a given width and calculate accordingly.

For example, there are 12 ends per pattern in Fig.1 and 7 patterns on 1¼ inches.

$$\frac{7 \text{ (ends) x } 12 \text{ (patterns)}}{1.25 \text{ (inches)}} = 67.2 \text{ ends per in.}$$

The greater the width measured and the number of patterns counted, the less the liability of error. When the full width of cloth is available for analysis purposes, it is advisable to measure and count the whole number of complete patterns, omitting sections of patterns and selvages.

The layout of the entire warp is as follows:

White for selvages.	White for ground.	Blue.		White.	Blue.
10 as 9				= 10	
	4	8 } 8 }	164 times	=656	1,312
				=	8
10 as 9				= 10	
				676	1,320

676 + 1,320 = 1,996 ends in the warp.

The selvage ends, with the exception of the two outer ends on each side, are drawn single. The two ends at each side are drawn together as one.

The entire 164 complete patterns in the above warp layout occupy 29¼ inches in the cloth.

$$\frac{12 \text{ x } 164}{29.25} = 67.2 \text{ ends per inch.}$$

LOOM REQUIRED.

These goods may be woven on single box cam or dobby looms, the former preferred. Six harnesses would be necessary if wire heddles were used on a dobby loom, whereas three twine harnesses would be sufficient. The ends are drawn in straight and the selvages drawn the same as the ground yarns, one end through each heddle and three ends per dent.

FINISHING.

There is practically no finish given these goods, beyond burling, brushing and making up.

Carding and Spinning Particulars.

The yarns of which Bengal stripes are made are manufactured in mills of the first division as given in a previous article. The method of mixing the cotton in these mills would probably be by hand. In the up-to-date mills, however, openers are employed, especially if a large amount of cotton is used. The method generally used in such a case is to have several high-speed openers attached in a row, the cotton being delivered on an endless apron, which carries it to a blower. This fan blows the cotton to the picker room to a condenser, which in turn deposits the open cotton upon an endless apron, which runs over the mixing bins. At every bin there is a chute which, when dropped, allows the cotton to be dropped into the bin.

AN IMPORTANT POINT

to look out for, when this method is used, is the danger of fire. By this method the cotton is thoroughly opened and may be used as fast as delivered, as it is in a loose, fluffy, dried-out condition. The number of openers used is according to the amount of cotton required by the mill. When this method is employed, the good

sliver up to the slubber is put into the center hopper. This insures a thorough and uniform mixing of this waste, which is always the "bugbear" of cotton mills. The stock used for Bengal stripes varies according to the quality of cloth desired, but generally a ⅞ inch to 1 inch staple is used. An opener and two processes of picking are used.

THE HOPPER

of the opener should be well filled and connected directly with the breaker picker. The speed of this beater, which is of the three-bladed, rigid type, is 1,-400 revolutions per minute. In this breaker picker there are two beaters and two sets of cages. The forward beater is a two-bladed beater and the speed of this is also 1,400 revolutions per minute. The total weight of a lap at the front end is 40 pounds or a 20-ounce lap. The picker tenders generally allow this lap to be made as large as possible, but the weight per yard remains the same. These laps are put up at the finisher picker and doubled 4 into 1. This picker is equipped with either a two-bladed, rigid or a pin beater; in either case the speed is 1,450 revolutions per minute. The total weight of the lap is 46 pounds net for a 52-yard lap, or about a 14⅛-ounce lap. This lap is put up

AT THE CARD,

the draft of which should not exceed 100. The speed of the cylinder should be 165 revolutions per minute; licker-in, 375 revolutions per minute, and flats one complete revolution every 45 minutes (110 flats). The fillet of the cylinder should be No. 33s wire or 100s and for the doffer and top flats No. 34s wire or 110s. The cards should be set and ground the same as given for indigo prints. The cards should be stripped three times a day of 10½ hours. The weight of the sliver per yard should be 55 grains and the production 900 pounds for a week of 60 hours. This sliver is put through two processes of drawing, six ends up at both the breaker and finisher drawing. The weight of the sliver is 75 grains at the finisher. The speed of the front roll is 400 revolutions per minute. The drawing should be sized three times a day. For this class of work either metallic or leather covered top rolls may be used, but in either case should be looked after to see that they are in perfect condition. Watch the

STOP-MOTIONS

to see that they are in perfect working condition, and that the frame tenders do not block them up with cotton to keep them from working. The drawing sliver is now put up to the slubber, where it is made into .40 hank roving. Be careful to set the bottom steel rolls properly, so as to obtain the best results, and watch the twist and tension. The slubber roving is made into 1 hank for warp and 1.20 hank for filling at the first intermediate and at the second or (in this case) the five frame is made into 2.25 hank for the warp and 3.50 for the filling yarn. These rovings are then taken to the spinning room and at the warp frame made into 9s on a frame having a 3¼-inch gauge, 2⅛-inch diameter ring and a 7-inch traverse. This is then spooled, warped and put through a slasher. The roving for filling is spun into 16s on a filling frame having a 6½ to 7-inch traverse, 1½-inch diameter ring and a 2¾-inch gauge. This yarn is then conditioned.

Dyeing Particulars.

BLUE.

Eight per cent immedial indogene GCL. conc.; 10 per cent sulphide sodium; 4 per cent soda ash; 30 per cent Glauber's salt.

BLACK.

Ten per cent immedial black NRT.; 10 per cent sulphide sodium; 4 per cent soda ash; 30 per cent Glauber's salt.

BROWN.

Five per cent immedial cutch O.; 5 per cent immedial brown BR.; 10 per cent sulphide sodium; 4 per cent soda ash; 30 per cent Glauber's salt.

OLIVE.

Five per cent immedial olive B.; 5 per cent sulphide sodium; 25 per cent salt; 3 per cent soda ash.

DARK GREEN.

Ten per cent immedial dark green B.; 10 per cent sulphide sodium; 30 per cent salt; 4 per cent soda ash.

MAROON.

Eight per cent immedial maroon B.; 8 per cent sulphide sodium; 4 per cent soda ash; 30 per cent salt.

TURKEY RED

Turkey red is a name given to fabrics that have been subjected to the Turkey red dyeing process. They are usually cloths constructed with the plain or small twill weaves, and are found in various widths. They are used for signal flags, dress goods and for many other purposes where a bright red color that will withstand severe tests of light, wear and weather is required. The analysis of two characteristic fabrics shows the following construction data:

Sample 1. Plain weave; 64 ends and 52 picks per inch; 30s yarn in both warp and filling. A fabric of this type could be woven on either automatic or ordinary plain cloth looms.

Sample 2. Three end twill weave, for ground; 66 ends and 72 picks per inch; 36s warp for the ground of the cloth, and 2-36s warp for the selvages; 24s filling. The ground of this sample is drawn one end in each hed-

Fig. 1.

Fig. 2.

dle and three ends in each dent. The selvages weave two ply ends as one, 2 picks in each shed (Fig. 2), with catch thread on the outside, and are reeded 2 ends per dent. The two ply ends, as one, represent 4 single strands of yarn in each dent. There are 16 ply yarns in each selvage.

It would be advisable to weave a fabric of this character on a dobby, in preference to a cam loom, because of the difference in weave of selvages and ground. The former being on 4 and the latter on 3 picks necessitates 12 picks before they repeat together. Six harnesses would be required for the ground ends, and 3 for the selvage ends, one of which would be for the catch thread.

CALCULATIONS.

In analyzing the twill fabric, a piece 2½ x 4 inches was found to weigh 12 grains, i. e., 10 square inches weigh 12 grains.

12 divided by 10 equals 1.2 grains per square inch.

The average number of the yarn was found as follows: 66 (ends) plus 72 (picks) equals 138 inches, which weigh 1.2 grains. 138 divided by 1.2 equals 115 inches per grain. 115 plus 10 per cent (for take up) equals 126 inches of yarn per grain. 126 times .2314 equals 29.1, say 29, average number.

By comparing the relative sizes of the yarns, warp and filling, by crossing and twisting them, it was found that 18 ends of warp were of the same diameter as 12 picks of filling.

Assuming the warp counts to be 36s, the filling counts were found as follows:

138 (sum of sley and pick) divided by 29 (average number) equals 4.76.

66 (sley or ends per inch) divided by 36 (warp number) equals 1.83; total 2.93.

72 (picks) divided by 2.93 equals 24.5, say 24, filling required.

Carding and Spinning Particulars.

The counts of the yarns of which Turkey red is made vary according to the quality desired. The stock being used also varies in length of staple and grade. In one of the samples taken for this article the warp yarn is 1-36s and the filling yarn is 1-24s. For these yarns and quality of cloth the staple of the cotton used would be 1⅛ of an inch in length and of a good grade.

THE MACHINERY USED

would be found in the second division of mills, as given in a previous article.

All bales of cotton should be graded and sampled before being put into the mixing and all those not up to grade and length of staple should be placed one side and not used in the mixing. If the mill is up-to-date or of a recent

construction the method of mixing would be as described in the last article. In older mills the cotton would be mixed by hand. If the latter method is employed, the mixing should be made from as many bales as possible and allowed to stand as long as possible to dry out.

PERIODS OF MIXING,

of course, vary according to the output of the mill in which the cloth is made. If space is plenty, which is not generally the case, a double mixing should be made, one mixing being used while the other is drying out, thus insuring that green cotton is not used. The cotton is then put through an opener and three processes of picking. The hopper of the opener should always be kept at least half full of cotton and the lifting apron should work easily and care should be taken to see that the slats are all whole. The pin beater should be adjusted so as to feed the proper amount of cotton to the breaker picker. This picker is generally of a combination type, having two sets of beaters and two sets of cages. The breaker beater speed is about 1,400 revolutions per minute, and is of a three-bladed, rigid type. The forward beater is generally of a two-bladed, rigid type, and its speed is 1,400 revolutions per minute. The

WEIGHT OF THE LAP

at this picker is 40 pounds, or a 16-ounce lap. These laps are put up at the intermediate picker and doubled 4 into 1. This machine has a single beater of two blades, rigid type, the speed of which is 1,425 revolutions per minute. The weight of lap at this machine is 38 pounds or a 12-ounce lap. These are put up at the finisher picker and doubled 4 into 1. The weight of a lap at the head end of this frame is 48 pounds or a 14½-ounce lap. In the picker room care should be taken to see that the drafts are properly regulated and that the eveners are working properly, and also that the cotton is thrown upon the top cage to help prevent splitting laps. Every lap should be weighed and a variation of one-half pound either side of standard weight is allowed. All laps varying over or under this allowance should be put back and run over again.

Roving waste is mixed in the good cotton in many ways, one of which has been previously given. The laps are then put up at the card. At this machine the speed of the licker-in should be 375 revolutions per minute. The flats should make one complete revolution every 45 minutes. The wire fillet used should be No. 33 or 100s for cylinder and No. 35 or 120s for the doffer and top flats.

THE CARD SETTINGS

should be the same as given in a previous article on indigo prints. Strip three times a day for a 10½-hour day and grind at least once a month. Keep the flats free from fly and all quick motions well oiled, especially the main cylinder bearings, which, if not properly attended to, beat up and cause blistering. The draft of this card should be about 100; the weight of the sliver is 60 grains per yard and the production is 700 pounds for a week of 60 hours. Watch the wire fillet to keep it sharp. For this sample we will consider the yarns to be combed. When this is the case, the sliver is taken from the card and put through the sliver lap machine, ribbon lap machine and the comber, or it may be taken from the card and put through a process of drawing, sliver lap and then to the comber. We will consider the former method. Here again a great deal depends on the size and make of comber being used. For this article we will take the older styles of six-head, 8¾-inch lap, combers. The weight of a yard of lap at the sliver lap machine (doublings being 14 into 1) would be 295 grains. At the ribbon lap machine the doublings would be 6 into 1, and the weight of lap 260 to 275 grains per yard. The laps are put up at the combers and doubled 6 into 1. The weight of the sliver is 48 grains per yard. Sixteen per cent of waste is taken out at the comber. The comber sliver is next put through two processes of

DRAWING FRAMES.

The weight of a yard of sliver at the finisher is 70 grains and the doublings 6 into 1 at each process. Size four times a day and don't skip a size. This sliver is put up at the slubber and made into .60 hank roving. For the

warp yarn this is put through two processes of fly frames; at the first intermediate it is made into 2.25 hank and at the fine into 7.50 hank. This is taken to the ring frame and spun into 36s on a frame with a 2¾-inch gauge, 1 9-16-inch diameter ring, and a 6-inch traverse, the spindle speed being 9,600 revolutions per minute. The yarn is then taken and spooled, warped and slashed.

The slubber roving for the filling is also put through two processes of fly frames. At the first intermediate it is made into 2 hank and at the second into 5 hank, after which it is spun into 30s filling yarn on a frame with a 2¾-inch gauge, 1⅜-inch diameter ring, 6-inch traverse, and spindle speed of 7,350 revolutions per minute. This yarn is then taken and conditioned.

Dyeing Particulars.

The dyeing of Turkey red has been handed down from generation to generation for the last 500 years, and possibly long before that time. The city of Adrianople, and also the city of Salonica, were formerly famous for this celebrated color. It is not so ancient as indigo blue, because the clothes around mummies in Egypt 2,000 years B. C. have indigo colors on them. The original Turkey red was a process of long duration. Thirty days were often consumed before the finished cloth or yarn was produced.

The cloth was oiled in olive oil, dried, and hung up in long chambers for some days, to age the goods, and fix the oil in the fibre. The goods were then oiled again, and aged, the process being repeated several times.

The short process of Turkey red is to oil with a solution of Turkey red oil, 20 per cent, and then dry. Oil again and dry, and allow to remain for a few hours in that state, and pass through a solution of acetate of alumina at 6 degrees Tw. Dry in hot air and pass through a dunging bath of cow dung and biarsenate of soda. This process will take away the surplus mordant from the cloth, and fix the alumina in the fibre. The cloth is well washed in water, and then dyed with about 15 per cent alizarine red paste, 4 per cent bullock's blood, 1½ per cent nutgalls, and enough acetate of lime to correct the water.

The goods are dyed for one hour, and well rinsed, dried and passed through a solution of Turkey red oil, about 5 per cent, dried, and steamed for one hour. The goods are then well soaped in a strong bath of hot soap, well rinsed, and finished as required.

LAMP WICKING

Lamp wicking is usually constructed of coarse, low-grade cotton yarns. There are three general forms or types: braid wicking, flat wicking and round, hose or tube wicking.

They are made in sizes varying from a small fraction of an inch, in the braid and flat types, for miners' and similar lamps, to several inches in width, in the flat and round types, for large oil lamps and stoves.

The principal objects sought to be secured in these goods are strength,

Fig. 1.

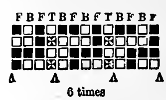


Fig. 2.

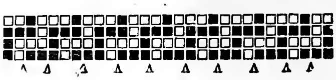


Fig. 3.

thickness and moisture-absorbing qualities.

BRAID WICKING.

This differs from a solid braid, as in braided rope and clothes lines, in having a core of very soft, coarse roving, around which have been braided finer yarns of a good strength and quality. There are 10 strands of roving for the core and 32 ends of fine 2-ply mercerized yarn for the braided covering. The latter imparts the requisite strength to the fabric, while the other desirable qualities are furnished by the roving. This wick is so constructed that the core could be withdrawn without interfering with the construction of the covering. There are about 72 yards per pound.

There are three methods adopted for making heavy, thick fabrics: First, by means of coarse yarns; second, by means of compound structures of cloth; third, by combining the first and second methods.

Flat lamp wicking requires an extra large surface, one deeper than can ordinarily be obtained by using coarse yarns in a single weave structure. It is usually woven with coarse warp yarns and comparatively fine, strong filling yarns, with double plain weaves of equal structure arranged 1 and 1 in both warp and filling, the two single fabrics being bound together into one compound fabric by other yarns, termed ties or binders, which interlace with both with more or less frequency. Where as firm a structure as is possible is wanted, the ties are arranged as extras to work the single plain weave, as shown by the crosses in Fig. 1. This entire figure is the base weave upon which the design for this wicking has been constructed. Ends 1 to 4, repeated, would form a tube or hose pipe fabric, the picks going first into one cloth and then the other on alternate picks. Solid type shows the face weave, type ⊡ the back weave, type ⊠ face ends raised when back picks are inserted. Back ends are depressed on picks 1 and 3, when face picks are inserted. The complete weave is shown in Fig. 2, and is on 38 ends and 4 picks. Letter F indicates face ends. B indicates back ends. T indicates ties. The arrows indicate where the ends are divided by the reed, eight dents being used.

The construction data of this wicking is as follows: Warp, 2-ply 5s cotton; filling, 2-ply 15s cotton; width, ⅝ inch; ends in wick, 38, of which seven are ties; picks per inch, 18½. The warp contains very little twist in the single strands and only five turns per inch in the ply yarn. There are no selvages such as are usually made on other types of goods.

ROUND, HOSE OR TUBE WICKING.

This wicking has been made with weave, Fig. 3, with two ends working together as one. An examination of this will show that it is constructed on the same principle as the first four ends of Fig. 1, the two cloths being tied only at the sides where the filling changes from interlacing with one series of ends to the other series every pick. The arrows indicate where the ends are reeded. The two outer dents on each side contain only four ends each, whereas the remainder of the warp is reeded six ends (3 doubles) per dent.

The construction of this wicking is as follows: Warp, 2-ply 5s cotton soft twisted; filling, 3-ply 15s cotton; width, 1⅜ inches; ends in wick, 106 as 53; picks per inch, 28; yards per pound, 15. The warp yarns are arranged 52 ends of white and 1 of blue, repeated once.

LOOM REQUIRED.

For braid wicking a braiding machine is required. For flat and round wicking, narrow width cam looms, varying in construction according to the weight and width of wicking to be woven, are used.

For the narrow wicking an ordinary tape loom may be used, in which each wicking has its separate warp or warps. The warps for wide wicking are usually run on wide beams, and the yarn divided in the loom. In order to make a soft wicking on these the tying ends are run from a beam as in an ordinary loom. The other yarns are run from one or two separate beams, and are regulated by an attachment which draws them forward in a positive manner in order to avoid the strain usually caused when the yarn has to draw the beam forward.

Each of the fabrics under consideration has been woven from one beam. In the flat wicking the plain ends work tighter than the other ends on account of the larger number of interlacings. This causes them to sink below the plane occupied by the double cloth ends and also causes the latter to be and appear somewhat loose.

FINISHING.

There is practically no finishing given these goods, as they are simply cut into definite lengths and packed, after being woven. The yarn for some of the wicking is bleached or dyed before being woven. Where colored yarns are used, they are usually arranged in the warp to make a striped fabric.

Carding and Spinning Particulars.

Manufacturers of wicking generally buy their yarns from cotton yarn mills and it is in this latter class of mills that coarse and fine counts of yarns are made. Generally speaking, the so-called yarn mills do not belong to any of the divisions of mills given in a previous article, but are rather in a class or division by themselves, being ready and equipped to fill orders for all counts of yarn, either carded or combed. Of course there are yarn mills making a specialty of fine yarns, but, generally speaking, this class of mills make yarn for the knitting trade, which as a rule does not call for as high counts of yarn as a fine goods mill.

In this class of mills a great many

MORE CHANGES

are made than in mills making cloth, some of the latter mills' card rooms running from one year's end to the next without a change in the hank roving or stock, whereas in the yarn mills changes are made daily. This is on account of filling the orders for small knitting plants, of which there are a great number throughout the country. Generally speaking, more care has to be used in a yarn mill than in a cloth mill, both on account of the many changes and also on account of the yarn being sold and not woven in the same mill, where the smaller defects may be covered. Of course, in both mills the yarn should run as even as possible, but this fault should be looked after particularly in yarn mills. In yarn mills

THE TWIST

of the yarn is less than in cloth mills, and this class of mills is generally equipped with mules instead of spinning frames to obtain this result. Particular care should be taken in yarn mills to see that no "mix-ups" occur in any part of the card room on account of the carelessness of those changing the gears, and it is a good idea to have specially prepared forms to be filled out when each change is made at the slubbers, fly frames and mules or spinning frames. After these forms are made out by the one making the change, they should be handed in and checked by the overseer.

For making the tube wicking, the counts of the yarn are as follows: 2-ply 5s warp soft twist and 3-ply 15s regular twist, while the filling or center portion or core is made up of 2-ply 1 hank roving. These counts of yarn are all made from the same

STAPLE AND GRADE

of cotton, generally cotton from ⅞ to 1 inch in staple of a good grade being used. In large mills an opening shed is built and the cotton is opened and fed to the opener hoppers or feeders, several being placed in a row and from here blown over to the mill proper, where it is received and carried by arrangements of endless belts to its proper bins. When the cotton is thus opened it is in a dry, fluffy state and may be used at once and does not have to stand, as is the case when the cotton is mixed by the hand method, which has been previously described.

The cotton is put through a feeder and three processes of pickers. The feeder picker should always be kept filled up with cotton, so that the lifting apron will always be filled up. The breaker beater is equipped with two sets of cages and two beaters. The breaker beater has three arms and blades, and its speed is 1,400 revolutions per minute.

THE FRONT BEATER

has two blades and its speed is also 1,400 revolutions per minute, but it must be remembered that the cotton does not receive as much beating as it does at the three-bladed beater, on account of having one less blade. The weight of a yard of lap at the machine is 16 ounces. On the breaker picker there is no evener and the amount of cotton fed is regulated by the distance of the pin or stripping beater from the lifting apron. The laps from this machine are put up and doubled 4 into 1 at the intermediate picker.

This picker is generally equipped with a two-bladed beater, its speed being 1,400 revolutions per minute. The weight of a yard of lap at the front is 12 ounces. This picker has an evener, which should be looked after carefully to see that it is doing its duty. The laps from this picker are put up at the finisher picker, and doubled 4 into 1. This picker may

be equipped with either a two-bladed, rigid beater or a pin beater which has three arms equipped with pins. If the latter beater is used, the speed for this style should be 1,400 revolutions per minute. The weight of a 50-yard lap should be 46 pounds or a 14.7-ounce per yard lap.

Every lap should be weighed and a variation of one-half a pound either side of standard allowed. All laps which vary more than this should be put back to be run over again. Care should be taken to see that every lap is weighed, and if laps do not weigh within the limit, the evener should be adjusted to allow the next lap to come within this weight limit. These laps are put up at the card, the draft of which should not exceed 100. The speed of the flats should be one revolution every 40 minutes (110 flats); the speed of the licker-in 300 revolutions per minute and the doffer about 13½ revolutions per minute. The general instruction for settings, grinding and stripping given previously may be followed. The

PRODUCTION OF A CARD

for 60 hours for this class of work is 850 pounds and the weight of the sliver 65 grains per yard. If the yarn is combed, it passes through the sliver lap machine, where it is doubled 16 into 1 for an 8¾-inch lap, the weight per yard being 420 grains. These laps are put up at the ribbon lap machine and doubled 6 into 1. The weight of a yard of lap at this machine is 440 grains for a 10½-inch lap. The ribbon lap machines should be sized twice a day and a variation of seven grains per yard allowed before changing the draft gear. These laps are put up on an 8-head comber and doubled 8 into 1. The weight of a yard of sliver at the delivery end of this machine should be about 65 grains per yard.

THE SAME SETTINGS

and timing for this machine may be used as have been given previously for a 6-head, 8¾-inch lap comber of the Heilman type of combers. The percentage of waste taken out is 18. This sliver is then put through two processes of drawing, the weight at the finisher drawing being 70 grains per yard. If the cotton is not combed, three processes of drawing frames are used, the weight of the sliver being the same as when combed. Size drawing four times a day, allowing two grains either side of standard weight. The drawing sliver is next put through the sl bber and made into .40 hank roving. From here it is passed to the first intermediate fly frame and made into 1 hank roving. The roving for the core is twisted slightly more than that used for the warp and filling yarns, generally 1 or 2 less teeth used on the twist gear being sufficient. The roving for the core is then twisted into 2-ply. For the warp yarn the yarn is soft spun at the mule into 5s yarn and then twisted into 2-ply yarn. For the filling yarn the first intermediate roving requires one more process of fly frames, which makes it into 3-hank roving. This is taken either to the mule room or the spinning room and spun into 15s, after which it is twisted, being made into 2-ply 15s yarn.

The rules and instructions for the top rolls given in previous articles may also be applied to this article.

EOLIENNE

Eolienne is the name applied to a fine dress fabric characterized by having the filling of a much coarser count than the warp, and in consequence producing a corded effect across the breadth of the goods. This class of goods is made up of a raw silk warp and either cotton or worsted filling, with the warp ends per inch greatly in excess of picks per inch.

In fabrics constructed on this basis

THE WARP THREADS

practically cover the filling and produce—with a silk warp—a very glossy fabric, another feature of an eolienne.

This fabric finds favor with the feminine sex practically the year round, being very popular for dressy indoor occasions in the cooler periods of the year, as well as dressy outdoor wear for summer.

The goods are made up in the gray, then dyed in the piece, in any color that the trade desires. The darker

shades find most favor for fall and winter use, while the lighter shades are preferred for summer wear. Eolienne

VARIES IN WIDTH.

The cotton filling fabric finishes at 27 inches, while the better grade worsted filling finishes at 40 inches and retails at from 85 cents to $1.25 per yard and the narrow cotton filling fabric retails at from 25 to 45 cents per yard. The variation in price is naturally influenced by the material in the goods, that is, the ends and picks per inch, consequently we find a comparatively wide range in the construction of these fabrics. The manufacturer, however, must bear in mind that the fabrics should be perfectly firm in order to withstand the wear of a dress fabric.

PLAIN WOVEN FABRICS

lend themselves more readily to a variation in texture with a given count of yarns than does any other method of interlacing warp and filling threads, this being due to plain woven fabrics having more intersections to the repeat of the weave than any other weave.

In varying the texture, we must bear in mind the nature of the material to be used, as certain kinds of yarns require less ends per inch than others of a given count to produce a firm fabric. In the construction of an eolienne which is made up of a silk warp, silk, being the smoothest of textile fibres, would require more threads per inch than a fabric composed of woolen fibres, as the silk threads will not cling to one another or full up in the finishing as would a fabric composed of woolen fibres; consequently silk warp fabrics usually have a very high warp texture.

ANALYSIS.

Cotton filling fabrics: Width of warp in reed, 30 inches; width of fabric finished, 28 inches; ends per inch in reed, 90; ends per inch, finished, 96.

Reed, 45 x 2.

Silk warp, 21-23s denier silk; cotton filling, 2-50s combed cotton; 58 picks.

WORSTED FILLING EOLIENNE.

Width of warp in reed, 44 inches; width of fabric, finished, 40 inches; ends per inch in reed, 150; ends per inch, finished, 166.

Reed, 50x3.

Silk warp, 21-23s denier silk; total number of ends in warp, 6,600; 40 ends additional each side or selvage, 80; total, 6,680 ends.

Worsted filling, 1-50s French spun; picks per inch, 64.

These fabrics may be woven on any light, smooth running roller or dobby loom. The warp is drawn straight on eight harnesses through French string heddles. The speed of the loom may with advantage run from 130 to 140 picks per minute.

FINISHING.

Eolienne requires little in this respect. After the goods reach the dyehouse, they are boiled off, then dyed as desired, run through the rotary press and made up into laps or rolls of about 40-yard pieces. Then they are ready for the commission house.

When eoliennes are made with dyed yarns the finishing process as noted is rather simple, but when raw silk and grey cotton yarns are used more numerous processes are necessary. The fabric has to be boiled out in order to take the gum from the silk, it has to be bleached, and handled in various methods to produce even results and then has to be dyed or printed, as the case may be. Sometimes such fabrics are dyed by a cross-dyeing process. wherein the silk will be one color and the cotton an entirely different color. In other instances the silk will remain white with the cotton dyed the color desired. Possibly there has been more improvement made during the past few years in the dyeing and finishing of these silk and cotton mixture fabrics than in any other section of the market.

Carding and Spinning Particulars.

The yarns for eolienne are made in mills of the third division as given in a previous article. The count of yarn taken for an example of this class of goods is 2-50s cotton filling, the warp yarns being made of raw silk. In this article we will give the foundation for making this count of yarn for this class of goods. While the count of yarn is not what would be called a fine one, still the general construction of

the goods calls for a fairly good length of staple of a good grade of cotton, sometimes the yarns being mercerized and gassed. The sample calls for a cotton of good grade of 1¼-inch staple. This cotton is put through two processes of picking, the speed of the beaters being 1,500 and 1,250 revolutions per minute, respectively, for the beater and finisher. The weight of the lap at the finisher should be 37½ pounds, or a 12-ounce lap. The card should be equipped with 35s wire fillet for the cylinder and 37s doffer and flats. The speed of the licker-in should not exceed 300 revolutions per minute; the speed of the flats, one complete revolution every 40 minutes, and about 9½ per cent of dirt, strip, etc., taken out. Strip three times a day and grind as before stated.

SETTINGS

should be close. Special attention should be paid to the licker-in, both as regards its speed and also as to its setting. The feed plate should be set far enough away not to break the staple and not so far as to allow the licker-in to continuously draw bunches into the cylinder. The draft should be about 110 and the weight of the sliver 55 grains per yard. The production should not exceed 525 pounds for a week of 60 hours. The cotton sliver is next put through a sliver lap machine, the doublings for an 8¾-inch lap being 16 into 1, the weight being 400 grains per yard. These laps are put up at the ribbon lap machine and doubled 6 into 1, and made into a lap on a 10½-inch spool. The weight of this lap should be about 420 grains. These are put up at the comber and doubled 8 into 1. For the Heilman machine the end cam should be set as follows: with the 80-tooth gear out of mesh, set roller on pawl arm in heel of large cam, turn index gear to 5½ and slide 80-tooth gear into mesh and bolt. Set detaching rolls to fluted segment with 21 gauge. Set nippers to open at 3½ index gear and close at 9¼. Set lifters down at 6¾ and up at 8¾ to 9; top combs down at 5; detaching rolls beginning to move at 6 and feed roll at 4, or according to amount of waste to be taken out. Set cushion plate to half lap with an 18 gauge and top combs to fluted segment with a 21 gauge. Use a 15-16 inch stock gauge. Use a 30-degree angle on nipper knife. For this stock take out 18 to 20 per cent waste. The weight of the sliver delivered is 60 grains per yard. Speed of comber is 90 nips per minute.

The sliver is next put through

TWO PROCESSES

of drawing frames. For this class of goods use a front roller speed of 350 and have leather top rolls well varnished and see that all stop-motions work properly.

Weight of sliver at finisher drawing frame is 70 grains per yard. At the slubber make .55 hank roving and use three processes of fly frames, the hank roving at each being 1.25 at first; 4 at second, and 10½ at fine frame. Spin the roving into 50s, on a ring frame, with a 2¾-inch spindle gauge, 1¼-inch diamond ring and a 5-inch traverse. If mercerized yarn is wanted, spin with a soft twist, otherwise use the regular cloth twist, which for this yarn would be as follows: twist per inch, 22.98; revolutions per minute of front roller, 100 plus; revolutions per minute of spindle, 7,250. After which the yarn goes through the usual processes to be twisted into 2-ply 50s.

Dyeing Particulars.

PINK.

One-quarter per cent Erika pink G.; 1 per cent sal soda; 10 per cent Glauber's salt.

LIGHT BLUE.

One-half per cent diamine SK. blue; 1 per cent sal soda; 10 per cent Glauber's salt.

OLIVE.

Two per cent diamine green G.; ½ per cent diamine fast yellow B.; ¼ per cent diamine brown B.; 1 per cent sal soda; 20 per cent Glauber's.

HELIOTROPE.

Two per cent diamine heliotrope; 1 per cent sal soda; 20 per cent Glauber's salt.

NAVY BLUE.

Eight per cent immedial indigo B.; 8 per cent sulphide sodium; 5 per cent soda; 20 per cent Glauber's.

MYRTLE.

Eight per cent immedial deep green B.; 8 per cent sulphide sodium; 5 per cent soda ash; 30 per cent Glauber's.

FAWN BROWN.

One per cent diamine brown B.; ½ per cent diamine fast yellow B.; ½ per cent sal soda; 20 per cent Glauber's.

SEAL BROWN.

Four per cent diamine brown B.; 1 per cent diamine fast yellow B.; 1 per cent diamine catechine B.; ½ per cent sal soda; 30 per cent salt.

BLACK.

Ten per cent immedial black NN.; 10 per cent sulphide of sodium; 30 per cent Glauber's salt; 5 per cent soda ash.

SAGE GREEN.

One-half per cent diamine green G.; 1 per cent sal soda; 30 per cent salt.

PEARL.

One-sixteenth per cent diamine dark blue G.; 1 per cent sal soda; 20 per cent Glauber's.

SLATE.

One per cent diamineral black B.; 1 per cent sal soda; 20 per cent Glauber's.

HANDKERCHIEFS

Cotton handkerchiefs are constructed in various ways. Some are made from ordinary plain cotton cloth cut up and either hemmed, embroidered (usually with initials) or ornamented with Battenburg or other forms of lace. Others are what may be termed "made in the loom," and are of such types as hemstitched, in which a leno weave is used for the four borders to make a perforated effect, and corded handkerchiefs, in which corded effects are made for both the side and cross borders.

They vary in size, weight and quality from the utilitarian red bandanna to the ladies' dainty ornamental lace article.

In a characteristic handkerchief of the cord type, the layout of the entire warp, including the drawing-in draft, is as follows:

	Ends.	Harness.		Dents.
Selvage	32 as 16	1 2		8
	32	3 4 5 6		16
Border	10 as 2	7 8		2
	6	3 4 5 6		3
	10 as 2	7 8		2
	6	5 6 3 4		3
	10 as 2	7 8		2
	14	3 4 5 6		7
	40 as 8	7 8		8
	14	5 6 3 4		7
	10 as 2	7 8		2
	6	3 4 5 6		3
	10 as 2	7 8		2
	6	5 6 3 4		3
	10 as 2	7 8		2
Body	1080	3 4 5 6		540
	152	Draw border		46
	56	3 4 5 6		28
			Skip	1
	56	3 4 5 6		28
	152	Draw border		46
	1080	Draw body		540
	152	Draw border		46
	32	3 4 5 6		16
Selvage	32 as 16	1 2		8
	3008 ends			1369

From the above layout it will be seen that two handkerchiefs are woven in the loom at the same time, side by side, one empty dent separating them, and that one beam only has been used. Each warp cord border consists of 100 ends working as 20.

THE SAME EFFECT

could be obtained by using a coarser yarn, but the probabilities are that if this was done it would become necessary to use two beams. Twenty-eight dents have been occupied between the cords and center empty dent to allow ample width for turning the edges under for hemming purposes.

The construction data of this handkerchief are as follows: Warp counts, 32s; filling counts, 40s; ends per inch, 72 in plain part, 79 average; picks per inch, 70 in plain part, 77 average; ends in handkerchief, 1,504; picks in handkerchief, 1,454; width in loom, 40 inches; width in gray, 38 inches; weight, 4.5 yards per pound.

One of the principal points to consider in handkerchief weaving is the arrangement of the chain draft for the filling pattern and loom mechanism so that there will not be any more bars of pattern chain used than is necessary.

THE FILLING PATTERN

of the handkerchief under consideration contains 1,454 picks. On an ordinary dobby head this would require 727 bars of double index, or 1,454 bars

of single index chain. To avoid this excessive amount of chain there are several devices or loom attachments now on the market, comprising double or more cylinder repeater, multiplier, or handkerchief motions.

Most of these require separate chain bars for the two borders and a certain number of bars for the plain, varying according to the type of motion used.

Fig. 1 shows the chain draft that has been used to produce the handkerchief

The handkerchief was woven in a single box dobby loom from one beam. **It might at first thought appear to be an advantage to weave cross borders of this type with coarse filling in a 2x1 box loom, using one pick of coarse instead of five picks of fine filling, but the lower speed at which it is necessary to run box looms and the more attention they require from weaver** and loom fixer lessen this seeming advantage. Single box cam looms, with

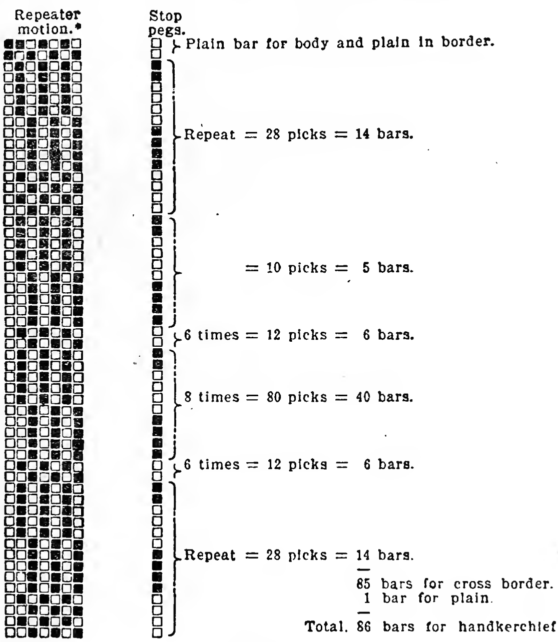


Fig. 1.

referred to, with the layout shown; 86 **double-index bars have been used for** each handkerchief, one for the plain in center and borders, and 85 for the cord **cross borders, with a repeat motion that is not on the market. The sel**vages have been woven plain. The **harnesses for these have not been indicated on the chain draft, because they are worked in a positive manner by the lifter knives.**

*Repeater motion refers only to left-hand vertical series of squares.

handkerchief motions attached, in **which sliding cams work the plain weave or remain in an open-shed position** for a number of picks as required, **are sometimes used. These admit of a much greater speed and steadier motion than dobby looms.**

FINISHING.

Cord handkerchiefs are usually bleached, cut, hemmed, folded, pressed **and made up as required. Plain cloth** handkerchiefs are similarly treated or **are printed, usually red and white or**

blue and white, instead of being bleached.

Carding and Spinning Particulars.

The yarns that compose handkerchiefs are made in mills of the second and third divisions, as given in a previous article. Generally speaking, handkerchief yarns are combed, even the coarser yarns for the poorer quality of handkerchiefs. The handkerchief taken for a sample is made up of 32s warp yarns and 40s filling yarns, and it is often found that a different count of yarn is used in the cords.

For the sample under description, a good quality of American cotton of about 1⅛ staple would be used. This would be mixed as has been before described,

MACHINE MIXING

being used if possible, as it leaves the cotton in a more desirable condition. An opener and three processes of picking are used, although in some fine cloth mills only two processes of picking are used, and excellent results obtained. Some overseers consider that an intermediate picker is not necessary, and, in fact, claim that instead of benefiting the cotton, it is a detriment, as it puts neps into the cotton. While this may be true, good results are obtained by either process, and one has to be governed by circumstances as he finds them, as it very often happens in a cotton mill that no hard and fast rule can be given, the object being to get a good, clean, even yarn with strength, and on the mark as to count, and also to get as much as possible as cheap as possible. At the feeder have it feeding as even as possible and remember that on the pin roller

DEPENDS THE EVENNESS

of the lap at the breaker. The breaker is equipped with two sets of cages and beaters, the breaker beater having three blades, and making 1,400 revolutions per minute, while the front beater has two blades, and also makes 1,400 revolutions per minute. It will thus be seen that the cotton passing under the three-bladed beater receives one-third more beating than when passing under the forward beater of the same machine. A full lap should weigh 40 pounds, or a 16-ounce lap. If three processes of pickers are used, these laps are doubled 4 into 1 at the intermediate picker. The total weight of a lap at this machine should be 38 pounds, or a 14-ounce lap. At the finisher picker the doublings are also 4 into 1. The speed of a beater of this picker is 1,425, if equipped with a pin beater, and 1,450 if a two-bladed, rigid type is used. The total

WEIGHT

of a lap is 37½ pounds for a 40-yard lap, or a 15-ounce lap. All the laps as they are taken off the picker should be weighed, a variation of one-half a pound either side of the standard weight being allowed. The roving waste (cut) should be mixed as before stated, or better still if it is run through a special roving machine, and then put back into the mixing. In this manner scarcely any "lickin" laps are made, granted, of course, that too much cut waste is not being made, or too little cotton being used. Cut-roving waste and also card, sliver lap, ribbon lap, comber and drawing frame good waste is a serious problem, and it should not be allowed to accumulate, but should be used up as fast as made. The laps are put up

AT THE CARD.

This card is, generally speaking, the so-called English card. It should have as large a doffer as possible, either a 26 or 27 inch diameter being used by mill men nowadays. The size of wire fillet used should be that used for making medium counts of yarn, i. e., No. 34s or 110s for cylinder, and No. 36s or 130s for doffer and flats. The draft of the card should not be less than 110. The speed of the licker-in should be about 400 revolutions per minute. The flats should make one complete revolution every 40 minutes. Strip, grind and set as given in previous articles. The production of the card for a week of 60 hours should be 600 pounds. If this yarn is to be combed, it is generally run through the sliver lap machine, where it is

doubled 14 into 1, and weighs 250 grains per yard for an 8¾-inch lap, after which it is put up at the ribbon lap machine and doubled 6 into 1, the weight of a yard of lap at the front being 275 grains. These laps should be

SIZED TWICE A DAY,

a variation of 5 grains per yard either side of the standard weight being allowed before changing. At the comber use the same settings, timings and gauges as given in the last article. The combed sliver should weight 45 grains for a 6-head comber, and proportionately more for an 8-head comber. For these goods about 15 per cent of waste is taken out. Watch the needles on the half laps and top combs, for remember that if these are broken or bent, the cotton is not receiving its proper combing, and as this is an extra item in the cost, these little points should be looked after. Another part of the comber to watch is the table, to keep it free from dirt and oil, and well polished and smooth at all times. This is because after leaving the comber the cotton receives no more cleaning, so that dirt even in the sliver is apt to stay there.

PERCENTAGES OF THE COMBER

should be taken frequently and all comber percentages kept as even as possible, for if there is much variation it will show up and make uneven yarn. Another point to watch is the leather top rolls. These should be kept well varnished, with a varnish which will last at least three weeks, although the detaching rolls should be given one coat of varnish every week. Varnish should be applied with a brush. At the drawing frame, the comber sliver is put through two processes, the doublings being 8 into 1 at the breaker, and 6 into 1 at the finisher. The weight per yard at the finisher drawing frame is 70 grains per yard. At this machine

THE MAIN POINTS

to watch are the knock-off motions, roller settings and top rolls. For drawing frame top leather rolls a varnish should be used which is smoother and glossier than that used for the comber rolls. Usually this is obtained by using Venetian red, instead of burnt sienna, as a color mixing. At the slubber, the drawing is made up into .60 hank roving. Watch the twist and tension. If top leather rolls are varnished, the same varnish as is used for the drawing frame may be used, except for the fact that it is thinned down by adding acetic acid or vinegar. The roving is then put through two processes of fly frames. At the first intermediate it is made into 2 hank, and at the fine it is made into 6½ for warp, and 8 hank for filling. At these frames watch the following parts: tension, twist, setting of steel rolls, traverse and roving waste. Be sure to have no dead spindles. The

YARN FOR THE FILLING

is spun into 40s on a frame with a 1⅜-inch diameter ring, 5½-inch traverse, and a spindle speed of 8,800 revolutions per minute, after which the filling is conditioned, and is then ready for weaving. The roving for warp is spun into 32s, on a frame with 2¾-inch gauge, 1⅝-inch diameter ring, and spindle speed of 10,000 revolutions per minute. The yarn is then spooled, warped and put through a slasher, and run upon a beam at the front. Generally speaking, this beam is made up of sections of small beams known as handkerchief beams, on which are wound the required number of ends.

DIAPER CLOTH

Cotton diaper cloth may be considered a staple fabric, being made in the same widths, grades and patterns year in and year out.

Standard widths are 18 inches, 20

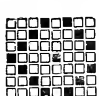


Fig. 1.

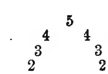


Fig. 2.

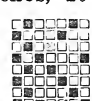


Fig. 3.

inches, 22 inches, 24 inches and 27 inches.

Essential qualities required for these goods are freedom from foreign matter, and ability to absorb moisture. Being subjected to excessive washings when in use, they have to be of fair quality.

For the ordinary qualities of goods, Allen Seed, Benders, Mobile, New Orleans and Texas cotton of middling and strict middling grades are used. In the lower qualities, card and roving waste is used for the filling.

CONSTRUCTION.

A diaper fabric under consideration is constructed as follows: Width, 18¾ inches, probably intended for 18 inches; ends per inch, 62; picks per inch, 46; warp counts, 30s; filling counts, 14s; weight, 7.83 yards per pound; weave, Fig. 1. The selvages consist of 24 ends of 30s as 12 on each side, and have been reeded 4 ends per dent; they weave plain. The body of the cloth has been reeded two ends per dent.

The combination of a filling flush weave, only one end out of 4 being up on each pick and a soft, coarse filling as compared to the warp, tends to make the face of the cloth very soft. This is aided by the finishing process, which renders the fabric absorbent to a large degree, as well as antiseptic.

Fig. 2 shows the center or point harness draft, and Fig. 3 the chain draft, to use to produce the fabric under consideration. As harness number 5 works like harness number 1, it might be omitted, and the ends drawn on number 1 instead.

If the ends were drawn in straight, the chain draft would be similar to the weave, with selvages extra.

CALCULATIONS.

$$\frac{46 \text{ (picks)} \times 20 \text{ (width in reed)} \times 100 \text{ (length of cut)}}{14 \text{ (counts} \times 840)} = 7.82 \text{ lbs. filling.}$$

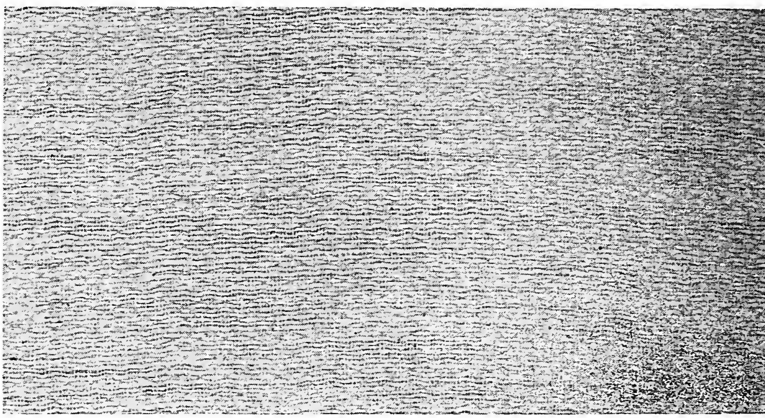
100 (yds.) ÷ 7.83 (yds. per pound) = 12.77 lbs., weight of cut.

12.77 — 7.82 = 4.95 lbs. warp.

18¾ (width of cloth) x 62 sley = 1,162.

1,162 + 24 for selvages = 1,186, total ends.

$$\frac{1{,}186 \text{ (ends)} \times 105 \text{ (length)}}{4.95 \text{ (weight)} \times 840} = 30\text{s warp counts.}$$



Diaper Cloth.

LOOM REQUIRED.

Diaper cloth may be woven on single box dobby or cam looms. If woven on the latter, a cam arrangement of 8 picks to the round, with selvage motion extra, would be required. As it is not necessary to stop production for ordinary misweaves, the cam loom would be the best to use on account of its steadier running.

The object of the finishing process is to rid the fabric of the cotton wax and foreign matter, and render it ab-

sorbent, white and clean. This is accomplished by treating with an alkaline solution of caustic soda, bleaching, washing and drying. It is then sterilized by formaldehyde or steam, dried, and made up, usually in 10-yard bolts covered with a sealed wrapper.

BALINE

Baline refers to a class of goods that is, in point of texture, between the coarser stuff known as burlap and the lighter and somewhat finer material known as canvas.

Baline is practically a coarse kind of canvas. It is made from the best grades of jute, flax and hemp and is used for numerous purposes. The very coarse quality is used principally for wrapping merchandise, and the finer grades are used for curtains and upholstery purposes, and also for stiffening wearing apparel, etc.

Baline, as used for stiffening wearing apparel, is inserted between the surface cloth and the lining, usually at the lapels and sleeves, in order both to stiffen and retain the shape of setting of that portion of the garment.

THE GOODS

are made in various widths; that used for upholstery purposes ranges from 50 to 64 inches, and that used for tailoring purposes usually comes in narrow widths from 22 to 36 inches. The narrow goods, however, are usually woven double width with fast center selvages, then cut in two parts during the finishing.

Baline is made in several qualities. The best grades are made up entirely of tow yarn, a short flax fibre, another grade is made with a combination of tow yarn and hemp or jute, and the lower qualities are usually made entirely from either hemp or jute.

In the combination fabric the hemp or jute usually figures as filling, while the flax or tow yarn is used for the warp, because the latter is with less difficulty made up into a smoother and stronger thread than either hemp or jute. The warp and filling for these goods interlaces on the plain weave system. The goods used for decorating purposes are dyed in the piece and the prevailing colors are dark red, garnet, and various shades of blue. The goods used for wrapping merchandise and tailoring purposes are finished in their natural color, which is a kind of drab, or light brown, depending on the material used in the construction of the goods.

The baline used for tailoring purposes is the finest in point of texture, and the goods used for decorative purposes closely resemble the common burlap, as far as texture is concerned. In the finishing, the coarser grade of baline receives considerable attention, being dyed and sheared, and presents a much more attractive appearance than the common burlap, which is only pressed after it comes from the loom.

Analysis of goods used for stiffening:

Width in reed, double width, 50 inches; finished at 47½ inches.

Reed, 16 x 2, 34 picks per inch; warp, 12 cut tow yarn; filling, 12 cut jute; ends in warp, 1,600; extra ends for all, 8; total, 1,608; weight per yard, 15 ounces.

Take-up in warp during weaving about 15 per cent.

FINISHING.

The finishing of these goods depends entirely upon the use for which the fabric is intended. The quality used for upholstery purposes and curtains is dyed after the goods are woven, then sheared on both sides and usually softened, especially so if intended for curtains. The goods used for tailoring purposes are finished in their natural color and stiffened. Some are stiffened much more than others, depending on the use for which they are made. The materials used for stiffening are glue and flour. If a very stiff finish is desired, equal proportions of glue and flour are used. The goods used for wrapping are merely sprinkled, then pressed, after which they are made up into rolls or laps.

Dyeing Particulars.

NAVY BLUE.

Three and one-half per cent formyl blue B; 30 per cent Glauber's; 2 per cent alum.

BLACK.

Five per cent jute black G.; 30 per cent Glauber's; 3 per cent alum.

RED.

Five per cent fast red R.; 30 per cent Glauber's; 3 per cent alum.

SKY BLUE.

One per cent patent blue B.; 25 per cent Glauber's; 3 per cent alum.

Most of the acid colors can be dyed on this fabric with Glauber's and alum at the temperature of about 190 degrees, in a jig dye machine. The goods are boiled out with Glauber's salt and sal soda to soften the fibre a little before the dyeing operation.

The addition of a little acetic acid the last fifteen minutes is beneficial to most colors.

HONEYCOMB CLOTH

Honeycomb cloth derives its name from its very close resemblance to an ordinary wax honeycomb.

In combination with other weaves the honeycomb type of weave is extensively used in the manufacture of honeycomb and so-called crochet quilts. It is also used for cotton warp and wool filling shawls and baby carriage robes, in which the warp is considerably finer than the filling in order that it will show as little as possible.

The honeycomb type of weave was formerly used to some extent in the construction of cotton toweling. The cell-like fabric, which is practically identical in appearance on both sides, would appear to be excellently adapted for toweling, the plain weave portions giving the necessary strength and the long floats of yarn steadily absorbing moisture, but for some reason or other it is not seen in the market to any extent at the present time.

Low and medium counts of yarn are usually used for honeycomb cloths.

Figs. 1 and 2 illustrate two honeycomb weaves, on 8 ends by 6 picks and 8 ends by 8 picks, respectively. A study of these will show that some ends and picks interlace more than others in a repeat of the weave and that they are constructed on diamond bases.

Unlike the majority of single weave cloths, the effect in honeycomb cloth differs entirely from that seen on the design paper, the diamond effect on the paper being substituted by the cellular effect in the cloth. This feature is due to the fact that yarns appear more or less prominent, when woven into the cloth, according to the

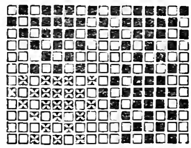


Fig. 1.

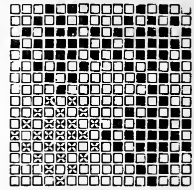


Fig. 2.

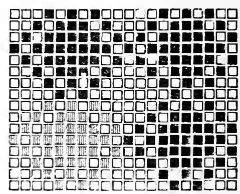


Fig. 3.

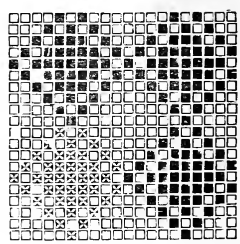


Fig. 4.

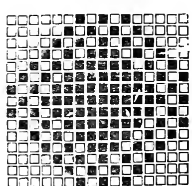


Fig. 5.

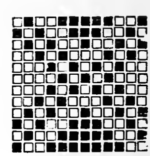


Fig 6.

smaller or greater amount of interlacings, respectively.

WEAVES.

In the type of cloth under consideration the longer floats of warp and filling form the ridges of the honeycomb cells, while the yarns which interlace to a greater degree form the recesses of the same. The long warp floats on one side are opposite the filling floats on the other.

Honeycomb weaves vary in size within certain limits. The larger the weave, the less firm the structure of the cloth. Figs. 3 and 4 illustrate weaves on 10 x 8 and 10 x 10, respectively. With the same amount of material, cloths constructed with these would not be as firm as they would if weaves Figs. 1 and 2 were substituted.

When large effects are desired, the weave is modified and strengthened by the addition of a plain weave around the diamond, or, as it is termed, a double diamond is used for a base.

Fig. 5 illustrates a weave of this type.

Fig. 6 illustrates another variation of the honeycomb weave on 12 x 12. The type of design illustrated in Figs. 2 and 4 is the one generally used. The crosses in Figs. 1 to 4 indicate one repeat of the weave.

These fabrics are made on ordinary dobby looms. One beam only is used.

BRIGHTON CLOTH

Brighton cloth is distinguished by a general effect on the face somewhat similar to honeycomb cloth, but unlike the latter, it is not reversible, the appearance on the back differing from that on the face. The principal difference between honeycomb and Brighton weave effects is that the cells of the former appear of uniform size, on the square or rectangular base, whereas those of the latter appear in two sizes, large and small, alternately, both warp way and filling way, on the drop or plain weave order base.

Brighton cloth is not essentially a cotton cloth, the Brighton weave, which distinguishes the fabric, being used in fabrics made with other materials. The Brighton type of weave is used in making cloths intended for dress goods, also in combination with other weaves to form parts of large jacquard patterns, in substitution for the honeycomb weaves.

In designing the jacquard patterns care must be exercised to have the Brighton weave correct, the long floats of warp and filling being in certain positions in relation to each other, or the effect will be spoiled. For illustration, Figs. 1 and 2 are two weaves which at first glance appear to be similar. Fig. 1 is a correct Brighton weave and differs from Fig. 2 in having the long floats of yarn form a square, whereas

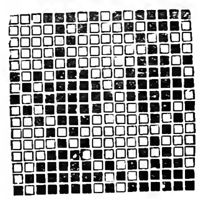


Fig. 1.

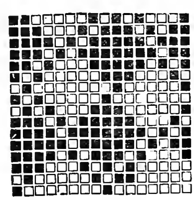


Fig. 2.

in the latter they form a cross. Figs. 3 and 4 represent the long floats in Figs. 1 and 2, respectively, vertical lines indicating warp floats and horizontal lines filling floats.

Figs. 5 to 7 illustrate the several stages in the construction of a 12 x 12 Brighton weave. Fig. 5 shows the 12 x 12 diamond base. Crosses in Fig. 6 indicate a second line of twill in one direction, added to the base, Fig. 5. Marks ◘ in Fig. 7 indicate where warp spots have been added in the left and right hand corners of the large spaces, the same now being divided into two

warp flush and two filling flush diamonds of equal size.

The ridges of the cells in the cloth are formed by the long floats of warp at the sides and the long floats of filling at the top and bottom of each diamond. The two sizes of cells are formed by the intervals between the ridges being greater and less (as will be seen by Fig. 3, which simply indicates the ends and picks covered by the long floats in one repeat of weave Fig. 1), thereby enclosing larger and smaller areas, alternately.

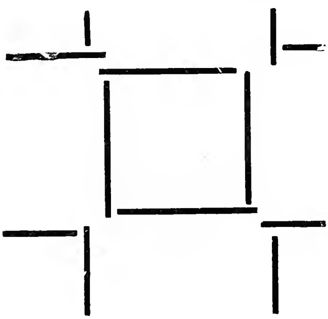


Fig. 3.

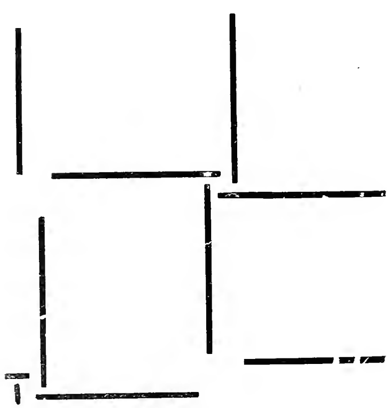


Fig. 4.

Brighton weaves are made on the same number of ends as picks, this number being a multiple of 4, on from 8 x 8 upward. Figs. 1, 7 and 8 are the weaves generally used, the same being on 16 x 16, 12 x 12 and 8 x 8, respectively.

LOOM REQUIRED.

Brighton cloth is woven on a single

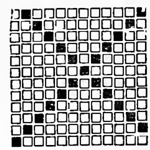


Fig. 5.

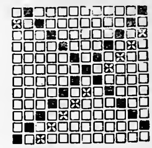


Fig. 6.

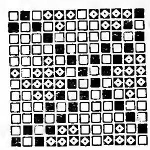


Fig. 7.

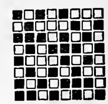


Fig. 8.

box dobby loom from one warp and one filling. It is usually woven white and piece-dyed afterward.

GALATEA

Galatea cloth has been somewhat in demand the past two or three years by women requiring serviceable and neat-appearing cotton fabrics at a medium price. One selling house advertises it as being particularly suitable for children's dresses that have to be subjected to excessive wear, washing and ironing; also for women's outing suits, and shirtwaists.

The demand appears to be increasing, probably partly due to the fact that one or more firms are specializing on the fabric and are advertising it.

GALATEA

is usually finished 27 inches wide and retails at 14 to 20 cents per yard. It is shown in plain colors as well as in figured, dotted and striped designs on white and colored grounds. The patterns are obtained by printing. Some manufacturers have evidently found that they can take a standard type of fabric and extend its use by varying the process of finishing it. The base of the cloth, i. e., the fabric previous to bleaching, dyeing or printing, is noth-

ing more than an ordinary 5-end warp sateen of fair quality.

A galatea in a

SIMPLE STRIPE PATTERN

is considered here, the analysis of which shows the following construction data: width of cloth, 27 inches; ends per inch, 124; picks per inch, 56; warp counts, 23s, right twist; filling counts, 24s, right twist; weight, $3\frac{3}{4}$ yards per pound; weave, 5-end warp satin. (Fig. 1.)


Fig. 1.

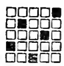


Fig. 2.

Each selvage consists of 24 ends working as 12 and weaves 2 picks in a shed. The cloth has been reeded 5 ends per dent in the body of the cloth and 6 ends per dent in the selvages.

CALCULATIONS.

27 inches x 124 sley equals 3,348 ends, plus 8 extras for selvages (there being 1 end per dent more than in the ground) equals 3,356, total ends.

$$\frac{3{,}356 \text{ (ends)} \times 105 \text{ (length)}}{23 \text{ (counts)} \times 840} = 18.24 \text{ lbs. warp in 100 yards of cloth.}$$

$$\frac{30 \text{ (width in reed)} \times 56 \text{ (pks.)} \times 100 \text{ (length)}}{24 \text{ (counts)} \times 840} = 8.33 \text{ lbs. filling.}$$

18.24 lbs. warp.
8.33 lbs. filling.

26.57 lbs., weight of 100 yard cut.
100 ÷ 26.57 = 3.76 yards per pound.

When weighing a small sample of the cloth under consideration $5\frac{5}{8}$ square inches was found to weigh 10.7 grains.

$$\frac{5\frac{5}{8} \text{ (sq. inches)} \times 7{,}000 \text{ (grs.)}}{10.7 \text{ (weight)} \times 27'' \text{ (cloth width)} \times 36 \text{ (inches per yard)}} = 3.78 \text{ yards per pound.}$$

LOOM REQUIRED.

Galatea can be produced most economically on single box cam looms in which an auxiliary motion is used for actuating the selvage yarns.

On account of the large number of ends per inch, and the fact that four out of every five ends are required to be on the face every pick, the cloth is woven face down in the loom and the harnesses actuated as shown in Fig. 2. The drawing-in draft is straight, with the ends drawn one through each heddle.

FINISHING.

The finishing of galatea is of simple character. It consists in bleaching, if for white, and printing, if for colored, patterns. A light starch, just enough to make the fabric handle firm, is used.

Carding and Spinning Particulars.

Galatea is made up of yarns the average count of which is about 25s. For this article we will consider the warp to be 23s and the filling yarn 24s, both right twist. The cotton used for this fabric would be upland cotton of a medium grade and 1-inch staple. If large quantities of this cloth are required, the mixing should be done by machines. Any of the methods previously described may be used, the object being to have a dry, fluffy cotton fed to the openers. If only a small mixing is going to be used, the mixing may be done by hand, but when mixed in this manner

THE MIXING

should be allowed to stand longer before using, so that it will become thoroughly dry and not have to be fed green. When cotton is fed green to the pickers there is more likelihood of a fire at these machines. The cotton is next put through three processes of pickers and an opener. At the breaker picker there are generally two sets of cages and two beaters. The first beater that the cotton comes in contact with has three blades and its speed is 1,100 revolutions per minute. The front beater of this machine has two blades and its speed is 1,425 revolutions per

minute. The total weight of the lap at this machine is about 40 pounds, although in a great many mills the laps at the front of the breaker and intermediate pickers are allowed to become as large as can be handled before doffing them. The weight per yard is 16 ounces. The laps from the breaker are put up and doubled four into one at the intermediate. The beater on this machine is generally of a two-bladed type and the speed of it 1,400 revolutions per minute. The total weight of a 40-yard lap is 37½ pounds, or a 15-ounce lap. At the finisher picker the beater may be either the pin or the two-bladed, rigid type. If the former, the speed should be about 1,350 revolutions per minute, and for the rigid type 1,450. It will be at once seen that a greater number of blows will be struck with the pin beater, but it is claimed that the pins of this beater enter the cotton and do not strike it as forcibly as the blade of a rigid type beater. On the other hand, many carders object to the pin beater, especially on the longer-staple cotton, claiming that it

PUTS IN NEPS.

For this fabric the total weight of a 40-yard lap should be 36¼ pounds. A variation of one-half either side of standard should be allowed and every lap weighed. Look out for split laps and see that every part of the picker is working freely, that the evener motions are in perfect order, for remember it is on this arrangement that the evenness of the lap depends. At the card the draft should not be over 105 The speed of the licker-in is 375 revolutions per minute. Flats (110) make one complete revolution every 45 minutes. Use medium count wire fillet. Strip, grind, clean, etc., as given in previous articles. The production for this fabric should be 850 pounds per week of 60 hours and the weight per yard of sliver should be 60. This is then put through three processes of drawing frames. For this class of goods

METALLIC ROLLS

may be used to good advantage. For this length of staple with metallic top rolls spread the bottom steel rolls as follows: Front to second, 1⅛ inches; second to third, 1¼ inches; third to back, 1⅜ inches. If leather top rolls are used instead, close rolls a good sixteenth. The speed of the front roll may be anything up to 400 revolutions per minute, according to the amount of drawing needed. As has been said many times before, as this is really the last machine at which evening takes place (to any great extent), watch to see that the stop-motions are working properly. Also watch the clearers and see that the sliver is being coiled properly in the can, because nothing causes more waste and trouble than poorly coiled sliver in cans. Size four times a day and allow a variation of two grains per yard (average) before changing. Scour drawings frequently. The weight per yard of sliver at the finisher drawing is 75 grains per yard. The doublings are 6 into 1. At the slubber, the drawing is made into .45 hank roving, after which it is put through two processes of

FLY FRAMES

and made into the following hank roving at each; first intermediate, 1.65; fine, 5 hank. This is taken to the spinning frame and for the warp is spun into 23s, with a right-handed twist. Otherwise than being twisted right-handed, the particulars are as follows: 2-inch diameter ring, 7-inch traverse, 9,500 revolutions per minute spindle speed and a twist per inch of 22.7 plus. The yarn is then spooled, warped and put through the slasher.

The filling yarn for this fabric is also a right twist, otherwise the particulars for the frame are as follows: 1½-inch diameter ring, 6½-inch traverse, spindle speed of 7,600 revolutions per minute. The yarn is then conditioned.

Dyeing Particulars.

Following are dyeing particulars for 100 pounds of goods:

PINK.

Four ounces Erika pink G.; 10 pounds Glauber's; 1 pound sal soda.

LIGHT BLUE.

Six ounces diamine sky blue FF.; 10 pounds Glauber's; 1 pound sal soda.

CREAM.

Four ounces immedial yellow D.; 2 ounces immedial cutch G.; 1 pound sulphide sodium; 2 pounds soda ash 10 pounds salt.

NAVY.

Ten pounds immedial indone B.; 10 pounds sulphide sodium; 3 pounds soda ash; 30 pounds salt.

WINE.

Six pounds brilliant Bordeaux R.; 2 pounds sal soda; 30 pounds Glauber's.

TAN.

One pound immedial cutch B.; pound immedial yellow D.; 3 pounds sulphide sodium; 30 pounds salt; 3 pounds soda ash.

VELOUR

Velour is a type of filling pile fabric of fair to good quality, made on the weave principles explained in the acticle dealing with velveteens. It differs from velveteen in having pile filling of some material other than cotton.

Velour for dress and cloaking purposes is made with 2 or 3 ply cotton yarns for the warp and filling of the ground cloth, and mohair or luster worsted filling for the pile. The cloth widths range from about 27 inches to 54 inches. The weights and qualities also vary, as will be inferred from a recent retail price list for 32-inch goods. These prices range from $2 to $4 per yard.

The better qualities of dress velours are usually from 27 to 32 inches wide.

Large quantities of velour fabrics are also used for curtain and upholstery purposes, the points of the fibres receiving and reflecting the light and indicating full, deep colors. The peculiar manner in which the cloth is constructed makes it an excellent wearing fabric. In jute velours, which are used for upholstery purposes to a greater extent than anomal fibre pile velours, the pile yarn is of jute.

In dress fabrics, velours are usually of solid color. For upholstery purposes they are of solid or various colors and patterns, the result of printing, embossing, cutting or burning.

The word velour, or velure, is also given to a pad or pile fabric used by hatters for smoothing and giving a luster to the surface of hats.

THE ANALYSIS

of a characteristic velour fabric, 50 inches wide, retailing for $2.25 per yard, indicates the following construction data: Ends per inch, 68; picks, per inch, 225, including 45 ground picks and 180 pile picks; warp counts, 2-ply 2's cotton; ground filling counts, 3-ply 45s cotton; pile filling counts, 25s worsted; weight, 21.13 ounces per yard. weave, Fig. 1. The picks are arranged 2 ground to 8 pile.

When analyzing pile fabrics care must be taken not to omit to consider the structure of the cloth. If analyzed as an ordinary fabric the weave for the fabric under consideration would ap-

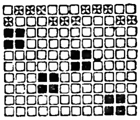


Fig. 1.

Fig. 2.

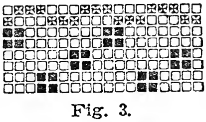


Fig. 3.

pear as shown in Fig. 2. and there would appear to be an equal number of ground as pile picks. Fig. 3 shows a weave that could be used if the pile was required to be shorter and less dense than with Fig. 1. Crosses in Figs. 1 to 3 indicate ground picks; ■ indicate pile picks.

Another point to consider is the method of ascertaining the counts of the

PILE FILLING.

Obviously a definite length cannot be measured with any degree of accuracy

after it has been cut into very small pieces. Knowing the construction and weight of the fabric, and the counts of the ground yarns, the pile yarn counts may be found as follows:

$$68 \text{ (ends)} \times 50 \text{ (width)} = 3{,}400 \text{ ends.}$$

$$\frac{3{,}400 \times 105 \text{ (length)}}{10 \text{ (counts)} \times 840} = 42.5 \text{ lbs. warp.}$$

$$\frac{45 \text{ (picks)} \times 55'' \text{ (width in reed)} \times 100 \text{ (length)}}{15 \times 840} = 19.64 \text{ lbs. of ground filling.}$$

$$\frac{21.13 \text{ ozs. (weight per yard)} \times 100 \text{ (length)}}{16 \text{ (ozs. per pound)}} = 132.06 \text{ lbs. weight of 100 yard cut.}$$

$$\begin{array}{rl} 42.5 & \text{lbs. warp.} \\ 19.64 & \text{lbs. ground filling.} \\ \hline 62.14 & \text{lbs. ground yarn.} \end{array}$$

$$132.06 - 62.14 = 69.92 \text{ lbs. pile filling.}$$

$$\frac{180 \text{ (picks)} \times 55 \text{ in. (width in reed)} \times 100 \text{ (length)}}{69.92 \text{ (lbs.)} \times 560} = 25 + \text{ counts of pile filling.}$$

LOOM REQUIRED.

Velours require a two-box dobby loom of heavy pattern, with a special take-up motion on account of the large number of picks per inch. One beam only is required.

FINISHING.

The finishing process consists of cutting, singeing or gassing, scouring, bleaching (if for white), dyeing and drying. Upholstery goods are printed after being dried, usually by the discharge process. Embossed effects are almost entirely confined to solid color fabrics and are obtained by pressure under suitable heated and prepared rollers.

For other data regarding filling pile fabrics the reader is referred to the articles on "Velveteen" and "Velveteen Cutting."

Carding and Spinning Particulars.

Velour is made out of two different lengths of staple of American peeler cotton and a worsted yarn. The counts of yarn used in the sample under description are as follows: Warp counts, 2-ply 20s, which is made from 1-inch stock, and for ground filling counts 3-45s, which is made out of 1 3-16-inch stock, and for pile filling, 25s worsted yarns, which is equal to a 16 2-3s (single) cotton yarn. The cottons for both lengths of staple are stapled in the usual manner, and in large mills are mixed by machines, while in small mills, or mills using a small quantity of these lengths of staples, the mixing is done by hand. For both stocks the

PICKING PARTICULARS

are practically the same, and one method will answer for both. They are put through three processes of pickers and an opener, the breaker picker, being known as a combination picker, having two sets of cages and two beaters; the first, or that beater coming into contact with the cotton first, has three blades and revolves at a speed of 1,125 revolutions per minute, while the front beater is generally two-bladed, having a speed of 1,500 revolutions per minute. The total weight of a lap is 40 pounds or a 16-ounce lap. These laps are put up at the intermediate picker and doubled four into one. At this picker the beater is of a rigid, two-bladed type, and its speed is 1,425 revolutions per minute. The total weight of a 42-yard lap is 38½ pounds, or a 14½-ounce lap. At the finisher picker, the speed of a three-bladed, pin beater is 1,400 revolutions per minute, and of a two-bladed, rigid beater 1,450 revolutions per minute. The total weight of a 50-yard lap is 46 pounds net for the 1-inch stock or a 14½-ounce lap and 39 pounds net or a 12½-ounce lap for the 1 3-16-inch stock.

AT THE CARD

there are several minor changes from one stock to the other, the principal

ones being as follows: The distance from feed plate to licker-in should be increased so as not to injure or break the longer staple. For the shorter stock the draft should be not more than 100. Set feed plate to licker-in to 7-1,000ths gauge; flats to licker-in 7-1,000ths; doffer to cylinder, 7 1,000ths doffer comb to doffer, with a 10-1,000ths gauge, the other settings being the same as those used for indigo prints. For the longer stock set feed plate to licker-in, 17-1,000ths; flats to cylinder, 7-1,000ths; doffer to cylinder, 5-1,000ths, etc. The draft for this length of staple should not be less than 100 and 110 of a draft is better. The percentage of all waste at the card for 1-inch stock should not exceed 7¼ per cent and for 1 3-16-inch staple 8½ per cent. Strip, grind and clean as shown formerly when the same lengths of staple were being described. The weight per yard for 1-inch staple should be 60 grains per yard and for the 1 3-16-inch stock, 55 grains per yard. The

PRODUCTION

for a week of 60 hours should be as follows: 1-inch staple, 750 pounds and 1 3-16-inch staple, 550 pounds. The 1 3-16-inch stock is combed (although for all grades of velour the yarn is not combed). The general method used is as follows: Sliver lap 16 into 1 or an 8¾-inch lap; weight of finished lap per yard, 420 grains. The sliver laps are doubled 6 into 1 or to a 10½-inch lap, the weight being 440 grains per yard. These laps, in turn, are put up at the comber and doubled eight into one, the weight of the finished sliver being 65 grains per yard. Set the comber as before described for this length of staple. For this class of goods 16 per cent of waste is taken out. Use one of the receipts for varnish that have been given from time to time, and keep all leather rolls in good condition, no matter whether they are on sliver lap, ribbon lap, combers, drawing frames or slubbers and speeders. The sliver from the comber is put through two processes of drawing, the doubling 6 into 1 at each process. The speed of the front roll depends upon conditions, but a fair speed is 350 revolutions per minute. The weight per yard of finished sliver is 75 grains. The 1-inch stock is put through three processes of drawing, the weight of the sliver being 75 grains per yard. Size at the ribbon lap twice a day, an allowance of five grains per yard being allowed from standard before changing. At the drawing frame size four times a day, a variation of two grains per yard being allowed. The drawing frame should be set for 1 3-16-inch stock, front to second, 1 5-16 inch; second to third, 1 7-16 inch and third to back, 1 9-16 inch for leather top rolls; for metallic rolls, spread rollers ⅛ to ¼ of an inch farther apart.

AT THE SLUBBER

the drawing is made in .60 for both stocks, after which the slubber roving is put through two processes of speeders for 20s yarn, the hank roving at each process being 1.50 at first, and 4 at second. This is spun into 20s on a frame with a two-inch diameter ring; 7-inch traverse; 21.24 twist per inch, and spindle speed of 9,400 revolutions per minute, after which the yarn is spooled and twisted into 2-20s, then warped and put through a slasher. The slubber roving for 45s is put through two processes, the hank roving at each being 2.50 at first and 10 hank at the fine. This roving is spun into 45s on a frame with 1¼-inch diameter ring; 5½-inch traverse; 25 plus twist per inch and a spindle speed of 8,500 revolutions per minute. The yarn is then twisted into 3-45s and conditioned.

Dyeing Particulars.

WINE.

6 per cent brilliant diamine Bordeaux R.; 3 per cent sal soda; 30 per cent Glauber's; topped with 1 per cent saffranine.

NAVY BLUE.

8 per cent immedial indogene B.; 8 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt; topped with 1 per cent brilliant green G.; 1 per cent methyl violet B.

OLIVE.

6 per cent katigen olive GN.; 2 per cent katigen green 2 B.; 1 per cent katigen brown B.; topped with 1 per cent auramine; 1 per cent brilliant green crys.

BROWN.

6 per cent immedial cutch G.; 2 per cent immedial yellow D.; 1 per cent immedial brown B.; 10 per cent sulphide of soda; 3 per cent soda ash; 30 per cent salt; topped with 2 per cent auramine; 2 per cent Bismarck brown.

SLATE.

3 per cent immedial black NN.; 4 per cent sodium sulphide; 3 per cent soda ash; 30 per cent salt; topped with 4 ounces methyl violet B.; 1 ounce brilliant green B.

GRAY.

1 per cent immedial black NN.; 2 ounces immedial yellow D.; topped with 2 ounces brilliant green B.; 2 ounces methyl violet B.

FAWN BROWN.

4 per cent immedial brown B.; 2 per cent immedial brown RR.; 6 per cent sulphide soda; 3 per cent soda ash; 30 per cent salt; topped with 2 per cent Bismarck brown R.

BOTTLE GREEN.

6 per cent immedial green BB.; 2 per cent immedial dark green B.; 8 per cent sulphide sodium; 3 per cent soda ash; 30 per cent salt; topped with 1 per cent brilliant green B.

PEACOCK GREEN.

4 per cent immedial new blue G.; 4 per cent sulphide sodium; 3 per cent soda ash; 25 per cent salt; topped with 2 per cent brilliant green B.

All these shades are dyed with the sulphur colors, well rinsed with water and dyed again at 180 degrees F., and well rinsed in water again and dried.

BLACK.

10 per cent immedial brilliant black G.; 10 per cent sodium sulphide; 3 per cent soda ash; 30 per cent salt; topped with 4 per cent immedial indone B.; 4 per cent sodium sulphide; 3 per cent soda ash; 20 per cent salt. Rinsed and soaped.

GLORIA SILK or GLORIA CLOTH

Gloria silk or gloria cloth is a name applied to a fabric used extensively for umbrellas. This fabric is made up of fine organzine silk warp, and either cotton, worsted or mohair filling.

The finest grades of this fabric are made with a fine organzine silk warp and fine French spun Australian worsted filling of a very high texture, both warp and filling, while in the cheaper grades cotton is substituted for worsted.

The fabric made with silk and worsted is oftentimes used as a dress fabric, with a slight change in texture; the counts of the materials may be a little finer and the ends and picks per inch are less than in the umbrella fabrics.

The fabric used as dress goods is commonly known to the trade as lansdowne. This fabric, by reason of the texture, is softer to the touch than the gloria cloth.

Both fabrics are made in the gray, then dyed in the piece. The fabric used for umbrellas is usually dyed black and the fabric intended for a dress is dyed in various shades of solid colors, such as lavender, pink, blue, sometimes finished in pure white or bleached and sometimes the goods are dyed black, if the trade desires it.

A distinguishing feature of these fabrics in conjunction with the mate-

Fig. 1.

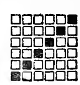


Fig. 2.

rials used is the weave, which is a three-end twill $\frac{}{1}$, and is woven in a width of about 45 inches in reed.

In the best grades of the umbrella fabric the construction is of such a high texture that the fabric need not be waterproofed as are some fabrics used as a protection against the ele-

ments, as, for instance, raincloth, which is rainproofed during the finishing process. The texture of the gloria cloth is sufficiently compact to be impervious to the rain.

ANALYSIS

follows of fabrics used for umbrellas and also fabrics used for dress goods.

First, Gloria cloth: width of warp in reed, 45 inches; width of fabric finished, 40-41 inches; ends per inch in reed, 55 x 3, equals 165; ends per inch finished fabric, 180; warp, 1¼ dram organzine silk.

Take-up during weaving, 8 per cent.

Practically no shrinkage in cloth in length during finishing.

Filling, 160 picks per inch; 1-70s French spun Australian worsted.

Second: Lansdowne: width in reed, 45 inches; width of fabric finished, 40-41; ends per inch in reed, 150—50 x 3 reed; ends per inch in finished fabric, 168; warp, 1¼ dram organzine silk.

Filling, 150 picks; 1-90s French spun Australian worsted.

These fabrics are woven on harness looms; the warp is drawn straight on six harnesses, through French string heddles. This particular heddle is almost indispensable in silk weaving.

Fig. 1, two repeats of weave.

Fig. 2, drawing-in draft.

Carding and Spinning Particulars.

Gloria cloth is made up from many different raw stocks, and may be either composed of worsted, silk, mohair or cotton yarns or a combination of any two. Gloria is sometimes called umbrella cloth on account of its extensive use for covering this article, and when used for this purpose it is generally constructed from cotton yarns. The counts of the yarn used vary from 40s to 60s, but a good average would be 45s for both warp and filling. The raw stock used for the better cloth is Egyptian cotton of 1⅝-inch staple, but it is the general rule nowadays to mix Allen 1⅜-inch staple cotton with the Egyptian, so as to cheapen the cloth, the proportion of American cotton used varying from one-sixth to one-half, the blending being generally done at the breaker drawing frame. The cottons should be mixed and up to the drawing frame run separately. They should be mixed in the usual manner; if a bale breaker is used better results will be obtained and the mixings will not have to stand as long to dry out as when hand mixings are made. The cotton is put through an opener and three processes of pickers. On the opener the stripping roll should be set about one-half an inch from the lifting roll and

THE HOPPER

should always be kept three-quarters full of cotton. The processes of pickers used may be three, as stated before, or two, the breaker being what is known as a combination picker, that is, having two beaters and two sets of cages. For various reasons the latter method is considered the better of the two. In this article we will consider the processes to be three separate pickers, although the speeds of the beaters given may be used if two processes of pickers are used. The speed of the breaker beater is 1,350 for a two-bladed beater and 900 revolutions per minute for a three-bladed beater. The total weight of a lap at the front would be about 40 pounds, or a 16-ounce lap. These are doubled 5 into 1 at the intermediate picker. The speed of the beater of this picker is 1,300 revolutions per minute. The total weight of a lap at this machine is 37½ pounds, or a 15½-ounce lap. These laps are put up at the finisher picker and doubled 4 into 1. The speed of this beater is 1,200 revolutions per minute, and the weight of a lap is 31½ pounds, or a 12½-ounce lap.

THE SPEEDS

of the beater given above are for the Egyptian stock. The Allen seed would require a higher speed of the beater to get the dirt out, the increase being about 100 revolutions per minute at each process. Every lap should be weighed as it is taken from the finisher picker, a variation of one-half a pound from the standard weight being allowed. The laps are then put up at the card and given a draft of 110. The speed of the flats is one complete rev-

olution every 40 minutes; set and grind as usual. The production should be about 500 pounds a week of 60 hours, the weight of the sliver being 50 grains per yard. Strip cards three times a day for a 10½-hour day. The card sliver is next put through a sliver lap machine, the doublings for an 8¾-inch lap being 16 into 1. The weight of a yard of this lap at the front is 280 grains. These are put up at the ribbon lap machine and doubled 6 into 1. The weight of a yard of lap at the front of this machine is 275 grains per yard. The spread of the rolls at the ribbon lap for this staple is, front to second, 1⅝ inches; second to third, 1¾ inches; third to back, 1⅞ inches. These laps are put up at the comber and doubled either 6 or 8 into 1, according to the number of heads the comber contains. For this article we will assume 6. The speed is 90 nips per minute, the weight of sliver delivered being 40 grains per yard. The percentage of waste taken out is 16. If larger laps than 8¾ inches are used the weight of the lap, etc., will be proportionately heavier. Set and time as given in a previous article. At the drawing frame the doubling at each of the two processes used is 6 into 1. It is at this machine that the blending is done, three ends of American cotton being run in with three ends of Egyptian.

THE WEIGHT

of the drawing at the front should be 50 grains per yard. The rolls should be set as follows: front to second, 1½ inches; second to third, 1⅝ inches, and third to back, 1¾ inches. Size four times a day and allow a variation of two grains per yard either side of standard before changing. Varnish and change leather top rolls frequently. At the slubber the sliver is made into .70 hank roving and is then put through three processes of fly frames, the hank roving at each process being as follows: First intermediate, 1.40 hank; second intermediate, 3.40 hank, and fine frame, 9.40 hank. The twist per inch put into the roving is very important, and for making these yarns the following twists are used at the slubber: 73 turns per inch; first intermediate, 1.01 per inch; second intermediate, 1.85 per inch, and fine, 3.7 per inch. Lay close and size fine frames once a day, and slubbers once a week.

BETTER RESULTS

are obtained if either self-weighted rolls are used on the fine frames or if not using self-weighted rolls take weight off of second roll and take one tooth of draft out between second and third rolls. Watch the leather rolls to see that they are in perfect condition. The yarn is taken to the mule room and spun with a soft twist for both warp and filling; the warp yarn is then run on to spools, after which it is warped and slashed and is then ready for the beam. Particular care has to be taken with this fabric to keep it free from neps on account of their showing up so plainly when made up on the umbrella, and it is a good plan to watch the beaters, flats and settings at the card, percentage and settings at the comber.

Dyeing Particulars.

Gloria cloth is made for the umbrella trade. When composed of silk and wool it is dyed by special colors, the colors dyeing wool and silk in one bath. For cheap imitation gloria cloths of cotton and wool, a union black is dyed: 5 per cent union black B.; 20 per cent Glauber's salt. Boil forty minutes, and run without steam for forty minutes longer. For

ALL COTTON CHEAP GLORIAS,

which are not glorias at all, as the only real gloria cloth is made from silk and wool, the aniline salt black is dyed; the goods are passed through a solution of aniline salt, dyed and aged and developed and washed.

CANVAS

Canvas is a term applied to heavy, plain weave cloths made with coarse, ply cotton yarns. It does not refer to any particular grade or weight of cloth.

Canvas cloth is used for mail bags, coverings for boats, in the manufacture of tents, etc. The

ANALYSIS

of a heavy characteristic canvas fabric indicates the following construction data: ends per inch, 31; picks per inch, 24; warp counts, 6-14s; filling counts, 9-14s; cloth width, 24 inches; reed width, 25¼ inches; weight, .72 (72-100) yard per pound; plain weave. A characteristic feature of heavy, plain cotton fabrics is seen in this cloth in that the warp has contracted in length about 25 per cent. Goods of this character would be woven on heavy cam looms of the type used for weaving duck.

Fig. 1 is a weave of the mock leno type, sometimes termed a canvas weave. Cloth made with this weave

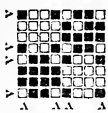


Fig. 1.

is characterized by small perforations, caused by some of the ends and picks, indicated by the arrows, cutting or opposing each other, while other ends and picks in the same weave come closely together. This cloth is used as a base or ground for embroidery work, and the perforations noted have a distinctive value as an aid in indicating readily where to insert the needle.

Carding and Spinning Particulars.

Canvas is made up in a great many grades, but usually the counts of the yarns do not vary as much for the different grades as for different grades of finer fabrics. The sample of canvas taken for description is made up of 6-14s warp and 9-14s filling This count of yarn (considering the fabric) would be made up from 15-16 to 1 1-16 inch staple, of a medium grade, and for this grade of fabric the cotton would not be combed. If large mixings are required, i. e., over 60 bales a day, a bale breaker should be used or some arrangement made whereby the mixing can be done by machines; if a smaller amount of cotton is required, then a hand mixing will answer. It will be found a great advantage to use machinery for mixing; any of the up-to-date machines and systems are all right. The cotton is next put through an opener and three processes of pickers. The pin roll, or, as it is sometimes called, the evener roll, should be set about one-half an inch from the lifting apron. The breaker picker is what is known as a combination picker, having two sets of beaters and two sets of cages.

THE BEATER

that first receives the cotton is generally of a three-bladed type and its speed is 1,400 revolutions per minute. The front beater of this same machine has two blades, and its speed is 1,450 revolutions per minute. The total weight of a lap at the front end of this machine is 40 to 50 pounds, according to length of lap run. Some overseers do not have a full lap knock-off on either the breaker or the intermediate picker, but the attendant doffs this lap at will. These breaker laps are doubled four into one at the intermediate picker. This picker is equipped with an evener motion and has a two-bladed beater, the speed of which is 1,400 revolutions per minute. The weight of a full lap is about 40 pounds, but generally this picker has no full lap knock-off, so the laps would weigh more or less for a full lap, but just the same per yard. Four of these laps should be doubled into one at the finisher picker. This is equipped with a pin beater, the speed of which is 1,400 revolutions per minute. The total weight of a 46-yard lap is 48½ pounds gross, or 46 pounds net, or a 12-ounce lap. Every lap should be weighed on this kind of stock, for it is generally a very sensitive cotton to weather conditions. Watch the evener motions to see that they are working properly and are clean. Run good sliver waste up in the usual manner. At the cards the draft should not exceed 100 and the flats should make one complete revolution every 40 minutes; set and grind as in-

structions in article on indigo prints. Strip out every three hours or three times (both cylinder and doffer) a day for a 10½-hour day. If humidifiers are run,

THE HUMIDITY

should be about 55 degees. The production of a card for a week of 60 hours should be 650 to 750 pounds, the weight of the sliver being 55 grains per yard. The card sliver is next run through either two or three processes of drawing as required for the quality of the canvas. In the sample three processes are used, six ends up at each process. The spread of the rolls for 1-inch stock with leather top rolls is as follows: front to second, 1⅛ inches; second to third, 1 3-16 inches; third to back, 1⅜ inches. For metallic top rolls spread of rolls ⅛ inch wider all through. Watch all stop-motions on this machine, for practically the last doubling is done at this machine, so that it is very important to see that the stop-motions are in good order. Varnish rolls as often as possible, and see that clearers are properly placed and picked. The sliver should be sized four times a day and should weigh 75 grains per yard. If humidifiers are used over these machines, they should give a mean temperature of 60 to 65 degrees. The drawing sliver is run through the slubber, and made into 40 hank roving. The settings for rolls at this machine are as follows: front to second, 1 1-16 inches, and second to back, 1¼ inches. Clean steel rolls of all laps, etc. The slubber roving is then put through two processes of fly frames, at the first intermediate being made into 1 hank roving and at the second, 3 hank roving. The roving on the finer frame should be sized once a day, the roll settings used for both being front to second, 1 1-16 inches and second to back, 1¼ inches; the doublings at each being 2 into 1.

AT THE SPINNING ROOM

the roving is spun into 14s on a warp frame with a 3-inch gauge of frame, 7-inch traverse, 2⅛-inch diameter ring, 17.77 twist per inch and a spindle speed of 9,000 revolutions per minute. This is then doubled into 6-14s or 6-ply 14s, after which it is put through a slasher and run on a beam.

The 14s filling yarn is made on a 1½-inch diameter ring, 6½-inch traverse, a 12.16 twist per inch and a spindle speed of 6,800 revolutions per minute. This yarn is then twisted into 9-ply 14s or 9-14s, after which it is conditioned, when it is ready to be woven.

BACK-CLOTH

Back-cloth is a reinforcing cloth used in calico printing to support a fabric being printed. Any plain cloth of suitable width may be used as a back-cloth, therefore the term does not refer to any particular width, weight or quality of fabric.

The back-cloth passes through the printing machine between the machine and the cloth to be printed. Both cloths, the back and the printed, emerge from the printing machine together. The back-cloth is immediately folded, whereas the printed cloth goes through other machines to "set" the color. The color on the back cloth, not being "set," is easily washed out. In a public cloth finishing establishment, the back-cloth is usually bleached, after serving its purpose at the printing machine, and finished as required. The back-cloth is usually wider than the cloth it is intended to support, and the color touches it only lightly on the outer portions.

Appendix.

CRASH

Carding and Spinning Particulars.

Crash is generally composed of yarns varying from 14s to 20s, both warp and filling having the same count of yarn. This class of fabric is made from cotton whose staple varies from ⅞ to 1 1-16 inches. For this article we will consider the counts of the yarn to be 16s and the staple of the cotton 1 1-16 inches in length. If large lots of this class of goods are to be handled, say over 35,000 pounds per week, preparing machines should be used, which are nothing more or less than several (from 3 to 7, according to capacity of mill) hoppers or openers in a row delivering the cotton onto an endless apron which carries it to and drops it into a line of trunking.

The cotton is conveyed to the mixing bins through this trunking, the motive power being powerful fans. This allows the cotton, when it reaches the bins, to be in a fluffy, dry state. This cotton is next fed to the openers and is passed through three processes of picking. At the

BREAKER PICKER

the cotton passes through first a 3-bladed, rigid type of beater, which has a speed of 1,100 revolutions per minute, and then a 2-bladed beater, the speed of which is 1,375 revolutions per minute. The total weight of a lap is 40 pounds, or a 16-ounce lap. At the intermediate picker the speed of the 2-bladed beater is 1,300 revolutions per minute, and the weight of the lap is 38 pounds, or a 13-ounce lap. At the finisher picker there is a pin beater (three arms) the speed of which is 1,350 revolutions per minute. The total weight of a 52-yard lap is 46 pounds net, or a 14⅛-ounce lap. Allow one-half pound variation either side of standard weight. At the card, set the same as for indigo prints. The top flats should make one complete revolution every 45 minutes. The sliver should weigh 60 grains per yard, and the production should be 775 to 825 pounds per week of 60 hours. Watch the setting points to see that all cards are set as nearly as possible alike. Strip three times a day and watch help to see that they strip every card. Grind as before stated. The sliver is next put through three processes of drawing frames. The speed of the front roll at the finisher for this stock should be 350 to 400 revolutions per minute, and the weight per yard of lap 75 grains. Watch the knock-off motions to see that they are all in proper working condition. For this class of work metallic top rolls may be used to excellent advantage. Size four times a day.

THE DRAWING SLIVER

is put through the slubber and made into .46 hank roving and from here put through two processes of fly frames, at the first intermediate being made into 1.10 hank, and at the second intermediate, or in this case the fine frame, 3.25 hank. Keep the top rolls in good condition and the bottom steel rolls set properly. This roving is taken to the spinning frame and spun into 16s warp yarn on a frame with 2¾-inch gauge of frame, 2-inch diameter ring, 7-inch traverse and spindle speed of 9,400 revolutions per minute; twist per inch, 19. This yarn is then spooled, warped and put through the slasher, where it is heavily sized.

The 3-hank roving for the filling yarn is spun into 16s filling on a frame with 1⅝-inch diameter ring, 6½-inch traverse, 13 twist per inch and spindle speed of 7,000 revolutions per minute. After leaving the spinning frame, the yarn is conditioned.

HAMMOCK CLOTHS

Carding and Spinning Particulars.

Hammock cloth is generally made in mills making low counts of yarn, or in

mills or small plants which make a specialty of this one grade of goods. The counts as well as the staple of the cotton differ according to the quality of the fabric to be made. There is also another factor which enters into the manufacture of this class of fabric and that is its strength. Strength in yarn may be obtained by several different methods, either doubling and twisting two or more yarns together or using a longer staple, or a combination of both, always considering that machines through the mill are properly adjusted and set. Another method to obtain strength is to twist, tighten, or in other words put in more twist per inch. For the sample of hammock cloth we will suppose it to be made up of 3-10s warp and filling, and we will assume the staple of the cotton to be ⅞ inch in length, straight cotton being used in the mixing. In the cheaper grades of this cloth comber and card stripping waste is put into the mixings in certain proportions. The cotton would be mixed by hand and

TWO PROCESSES

of picking used. The cotton should be allowed to stand as long as possible to dry out, so as to be more easily worked, and it also lessens the liability of fires in the picker. The breaker picker should be a combination picker with two sets of screens and two beaters. The back beater has three blades and a speed of 1,000 revolutions per minute. The forward beater has two blades and a speed of 1,400 revolutions per minute. If the lap measures 40 yards, the weight should be 40 pounds or a 16-ounce lap. Generally, however, the lap is allowed to run as large as possible before being doffed. These laps are doubled 4 into 1, and come under the action of a two-bladed, rigid beater, the speed of which should be about 1,375 revolutions per minute. The main points are to look out for fires, keep lappers very near full, watch the eveners and piano motions and keep all parts in good working order. The total weight of a lap at the finisher, for a 40-yard lap should be 37 pounds, or a 14½-ounce lap. Weigh every lap and allow a variation of three-quarters of a pound either side of standard. These laps are then put up at the card, which is fitted with coarse wire fillet.

THE DRAFT

should not be more than 90, speed of cylinder 165 and the licker-in speed 350 revolutions per minute. Flats make one revolution every 50 minutes (110 flats). Strip cylinders three times a day and doffer two times. The weight of the sliver should be 65 grains per yard and the production not less than 950 pounds for a week of 60 hours. The cotton is next put through two processes of drawing frames, the doublings being 8 into 1 at the breaker and 6 into 1 at the finisher. The weight per yard at the finisher drawing should be 80 grains; size three times a day. Metallic rolls may be used to good advantage for this class of work. Watch all the knock-off and stop-motions at this machine and also look out for cut drawing. The roll setting for metallic rolls for seven-eighths-inch stock is, front to second, 1⅛ inches, second to third, 1¼ inches, and third to back, 1½ inches. In a great many mills the sliver at the drawing frame is sized only twice a day. The cans of drawing are put up to and run through the slubber, which makes it into .60 hank roving, which is afterward put through one process of fly frames and made into two hank roving. Size this class of roving once a day at the fine frame. Look out to see that the hank clock cannot be moved and hanks made. It is next taken to the spinning room and made into 10s for warp on a frame with 3-inch gauge of frame, 2¼-inch diameter ring, 7-inch traverse and spindle speed of 8,600 revolutions per minute, after which it is twisted into 3-ply 10s at twister, and then spooled, warped and put through the slasher. For the filling yarn the two-hank roving is spun on a filling frame with a 1⅝-inch diameter ring, 7-inch traverse and spindle speed of 6,400 revolutions per minute, after which it is twisted into 3-ply 10s.

MADRAS

Carding and Spinning Particulars.

Madras is made up of various counts of yarn according to the quality wanted, and in the finer grades of this fabric, silk is used for the stripes. Egyptian or a fine Sea Island cotton is generally used in the finer qualities. In this article we will consider the filling yarn to be made up of 80s Egyptian cotton with a staple of 1⅝ inches. Egyptian cotton, generally speaking, is more easily worked than American cotton, and for this reason higher speeds are used than when the same counts of yarn are made from American cotton. The cotton is generally mixed by hand, after which it is put through three processes of pickers. At the breaker picker the speed of the three-bladed beater is 1,050 revolutions per minute. The total weight of the lap at the front of this machine is 40 pounds, or an 18-ounce lap. At the intermediate picker the speed of a two-bladed beater is 1,450 revolutions per minute, while the total weight is 38 pounds, or a 12-ounce lap. These are put up at the finisher picker and run through a two-bladed, rigid beater, the speed of which is 1,400 revolutions per minute. The total weight of a 50-yard lap is 37½ pounds, or a 12½-ounce lap. Allow the usual amount of variation from standard weight of lap, and follow instructions for the picker room for high-grade and fine yarns. The cotton is next passed to the card.

THE DRAFT

of this card should not be less than 110. The top flats should make one complete revolution every 30 minutes. The speed of the licker-in should be about 350. The weight of the sliver is 50 grains and the production for this class of goods is 475 pounds per week of 60 hours. Strip, grind, etc., the same as when Sea Island cotton is used. In mills that are especially equipped for fine counts of yarn the wire on the card will be fine. After leaving the card, the full cans are put up to the sliver lap machine. In the general type used the machine has 16 ends doubled into 1 at the front. This lap weighs about 295 grains per yard These laps are put up at the ribbon lap machine and doubled six into 1. The weight per yard of lap at this machine is 275. This is for a six-head comber. The comber is the next machine and at this machine the laps are doubled 6 into 1. The settings of this machine should be the same as when Sea Island cotton of the same length is used. The weight per yard of the combed sliver is 40 grains, and the speed of the comber 90 nips per minute. Several recipes for varnish for the leather-covered top rolls have been previously given and the following

RECIPE

will be found to be an excellent addition to those already given: Eight ounces of plate glue, 8 ounces of ground gelatine, 12 ounces of burnt sienna, one ounce of oil origanum, three pints acetic acid, one pint of water. The ribbon laps should be sized twice a day and a variation of five grains per yard either side of the standard weight allowed before changing. The combed sliver is next put through two processes of drawing frames, the weight per yard of a yard of finished drawing being 60 grains. The doublings at these machines are 6 into 1. Size the finishers four times daily and allow two grains per yard before changing. The cotton is next put through the slubber and made into .60 hank roving. This is then put through three processes of fly frames, at the first intermediate being made into 1.50 hank roving, at the second intermediate 4.50 and at the fine frame 16 hank. Egyptian cotton requires an extra tooth of twist as compared with Sea Island cotton of the same length of staple and hank roving. The middle top rolls on the fine or jack frame should not be dead weighted. This roving is taken to the spinning room and made into 80s yarn (filling) on a frame with a 1¼-inch diameter ring, 5-inch traverse, 29.07 twist per inch and spindle speed of 7,400. This yarn is then taken and conditioned.

GINGHAMS

Carding and Spinning Particulars.

The yarns that make up ginghams (common) vary from 26s to 40s for both warp and filling. For the sample of gingham under description we will consider the yarns to be No. 40s for both warp and filling. This yarn would be made from a medium grade of peeler cotton of about 1 3-16-inch staple. The cotton, after being put through a bale breaker or an opener known as a preparer, is put through three processes of pickers at the breaker picker. The speed of the three-bladed beater should be 1,150 revolutions per minute, and of the two-bladed beater of the same machine, 1,400 revolutions per minute. The total weight of the lap should be 40 pounds, or a 16-ounce lap. At the intermediate the speed of the beater should be 1,400 for a rigid, two-bladed beater. The total weight of lap should be 38 pounds or a 12½-ounce lap. The finisher picker should be equipped with a pin beater, the speed of which should be 1,425 revolutions per minute. The weight of a full lap should be 39 pounds or a 14-ounce lap.

At the card use the same settings, etc., as given for indigo prints. The flats should make one complete revolution every 50 to 55 minutes. Speed of doffer should be 350 revolutions per minute.

THE WEIGHT

of the sliver should be 60 grains per yard, and the production 800 pounds for a week of 60 hours. The sliver is next put through three processes of drawing frames, the speed of the finisher drawing being 400 revolutions per minute. Watch the settings, and size at this place four times a day, a variation of two grains either side of standard weight being allowed.

The weight of the sliver at the finisher drawing should be 70 grains per yard. Either metallic or leather-covered top rolls may be used to good advantage on this stock. The drawing sliver is next put through the slubber and made into .60 hank roving. This is put through two processes of fly frames and made into 2 hank roving at the first intermediate and 8 hank at the second. Watch the tension and waste, and be especially careful of mix-ups. Size the fine roving at least once a day. The roving is taken to the spinning room and made into 40s on a warp frame with a 1⅝-inch ring, 6½-inch traverse, 28.46 twist per inch and a spindle speed of 10,000 revolutions per minute. The yarn is then spooled and warped, after which it is run through the slasher. A good size is as follows: water, 100 gallons; potato starch, 54 pounds; Yorkshire gum, 2 pounds; white soap, 1½ pounds.

The 8 hank roving for filling yarn is made on a frame with 1⅜-inch diameter ring, 5½-inch traverse, 23.72 twist per inch and a spindle speed of 8,800 revolutions per minute. This yarn is then conditioned.

SCRIM

Carding and Spinning Particulars.

Scrim is made of cotton counts of yarn from 20s to 40s. For this article we will consider the cotton to be 1⅛-inch staple peeler of a medium of 32s count. This class of goods is made in mills of the first division, as given in a previous article. Large mixings should be made by hand and the cotton is then put through an opener and three processes of pickers. The breaker picker has two sets of cages and two beaters, the back beater having three blades and making 1,050 revolutions per minute. The front beater has two blades and makes 1,300 revolutions per minute. The total weight of a 40-yard lap at this machine is 40 pounds, or a 16-ounce lap. The speed of the beater of the intermediate beater (two-bladed) should be 1,400 revolutions per minute, and the total weight of the lap is 37½ pounds, or a 12-ounce lap. At the finisher the lap should weigh 39 pounds, or a 14½-ounce lap, while the speed of the beater (of a pin type) should be 1,400 revolutions per minute. Every lap should be weighed and a variation of half a

pound either side of standard weight allowed to pass, all others being put back to be run over again.

THE CARD CLOTHING

should be of a medium count wire, the wire for doffer and top flats being two points finer than the cylinder. The draft of card should be about 100 and the sliver should weigh 65 grains per yard. The production should be 750 pounds for a week of 60 hours. For other particulars for card follow those given for indigo prints. The cotton is next put through the sliver lap machine and doubled 16 into 1, the lap weighing 320 grains per yard. These laps are put up at the ribbon lap and doubled 6 into 1, the weight per yard being 440 grains for a lap 10½ inches in width. These laps are put up to an eight-head comber and made into a 65-grain sliver, taking out 17½ per cent of waste. For roller varnish and other particulars about comber, see article on madras. The comber sliver is put through two processes of drawing frames, the doublings being 6 into 1 at each process. The weight per yard of the finished drawing is 75 grains. The same roller varnish may be used on the drawing frames as at the comber. Size four times a day and look out for the knock-off motions to see that they are in proper working order. The sliver is next put through the slubber and made into .60 hank roving. This is then put through two processes of fly frames or speeders, the hank roving at each being as follows: First intermediate 2 hank, and fine 6½ hank. Keep the leather top rolls in good condition and watch to stop double, single and bunches.

THE ROVING

is then taken to the spinning room and spun into 32s on a warp frame with a 1⅝-inch diameter ring, 6½-inch traverse, 26.87 twist per inch and spindle speed of 10,000 revolutions per minute. The yarn is then spooled, warped and run through the slasher, where it is put through a special size.

The roving for the filling is spun into 32s on a frame with a 1⅜-inch diameter ring, 6-inch traverse, 21.21 twist per inch and a spindle speed of 8,800 revolutions per minute. This yarn is conditioned.

Some of the white cloths, such as ducks, pique, etc., which in most seasons are always white, may be dyed to follow a freak of fashion.

CREAM.

For 100 pounds goods, two ounces immedial yellow D.; 2 ounces immedial cutch B.; 1 pound sulphite sodium; 20 pounds salt; ½ pound soda ash.

MAUVE.

Two ounces diamine violet N.; 10 pounds Glauber's; 1 pound sal soda.

ECRU.

One-half pound immedial cutch G.; 4 ounces immedial yellow D.; 2 pounds sulphide sodium; 10 pounds salt; 1 pound soda ash.

SKY BLUE.

One pound immedial indone B.; 2 pounds sulphide sodium; 2 pounds soda ash; 10 pounds salt.

LIGHT SLATE.

One and one-half pounds immedial black NRT.; 3 pounds sulphide sodium; 20 pounds salt; 2 pounds soda ash.

PIQUE

Carding and Spinning Particulars.

The yarns for pique vary according to the quality wanted. A good quality and average grade of pique may be made from 30s yarns of 1⅛-inch peeler cotton (carded). After being put through a bale breaker the cotton is put through three processes of pickers, the speed of the beater at each process being as follows: 1,500 revolutions per minute (two-bladed beater) for the breaker picker, 1,400 for the intermediate picker (two blades), and 1,375 to 1,450 for the finisher picker, according to the grade of cotton used. The total weight of a finished lap should be 35 pounds or a 12½-ounce lap. At the card the draft should not be less than 100 or more than 110. The flats (110) make one revolution every 37 minutes. Strip three times a day. The weight of sliver should be 60 grains per yard;

production, 750 pounds for a week of 60 hours.

The card sliver should be put through three processes of drawing frames. These should be equipped with leather-covered top rolls, the speed of the front roll of the finisher drawing being 350 to 400 revolutions per minute, according to production required. The weight of the sliver from this frame should be 75 grains per yard.

The sliver is put through the slubber and made into .50 hank roving. For 9s filling yarn the slubber roving is put through one process of fly frames and is made into 2 hank roving. If a large quantity of pique is being made the yarn for 9s may be made of a much lower grade and staple of cotton, but otherwise it is better to construct the yarn by the method given.

The slubber roving for 30s yarn is put through two processes of fly frames, at the first intermediate being made into 2 hank and at the second being made into 7.50 hank. This roving is taken to the spinning room and spun into 30s on a warp frame having a diameter of ring $1\frac{3}{4}$ inches, length of traverse $6\frac{1}{2}$ inches, twist per inch, 26.02 and a spindle speed of 9,800 revolutions per minute. This yarn is then spooled and warped, after which it is run through the slasher.

The No. 9s yarn is made on a filling spinning frame with a $1\frac{5}{8}$-inch diameter ring, 7-inch traverse, 9.75 twist and a spindle speed of 6,200 revolutions per minute.

The 30s yarn is made on a frame with a $1\frac{5}{8}$-inch diameter ring, 6-inch traverse, 19.17 twist per inch and a spindle speed of 8,300 revolutions per minute.

INDEX